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FOR ENGINEERS AND CONTRACTORS CONTROLLING THE DESIGN, SPECIFICATION, INSTALLATION AND MAINTENANCE OF HEATING, VENTILATING AND AIR CONDITIONING.

HEATING & VENTILATING

AIR CONDITIONING

FOR JULY, 1939

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Single copies, this issue, $1; to subscribers, 30 cents.

Apartment House Issue

FOLLOWING a policy of long standing in aiming to keep our readers abreast of new moves and tendencies as they occur this issue is devoted largely to apartment house work.

There is a lot of this work going on and much more is in prospect in the next several years. You should be ready to take advantage of this situation. To do so you should know what is going on yourself and should have adequate tools with which to work.

The intent of this issue is to assist in meeting both of these necessities.

The cases of recent apartment house installations described should help to recall to your own mind that a good modern plant is a real advantage to the owner in keeping down operating costs and in holding tenants. They should also show you that in spite of what may have been true some years ago it is now possible to get owners to put in plants which make use of the latest developments.

Additionally, these cases can be used as a tool when talking with owners who may need some concrete example of what is going into the new apartment houses in order to be convinced that they also should have a modern plant.

C. H. B. Hotchkiss

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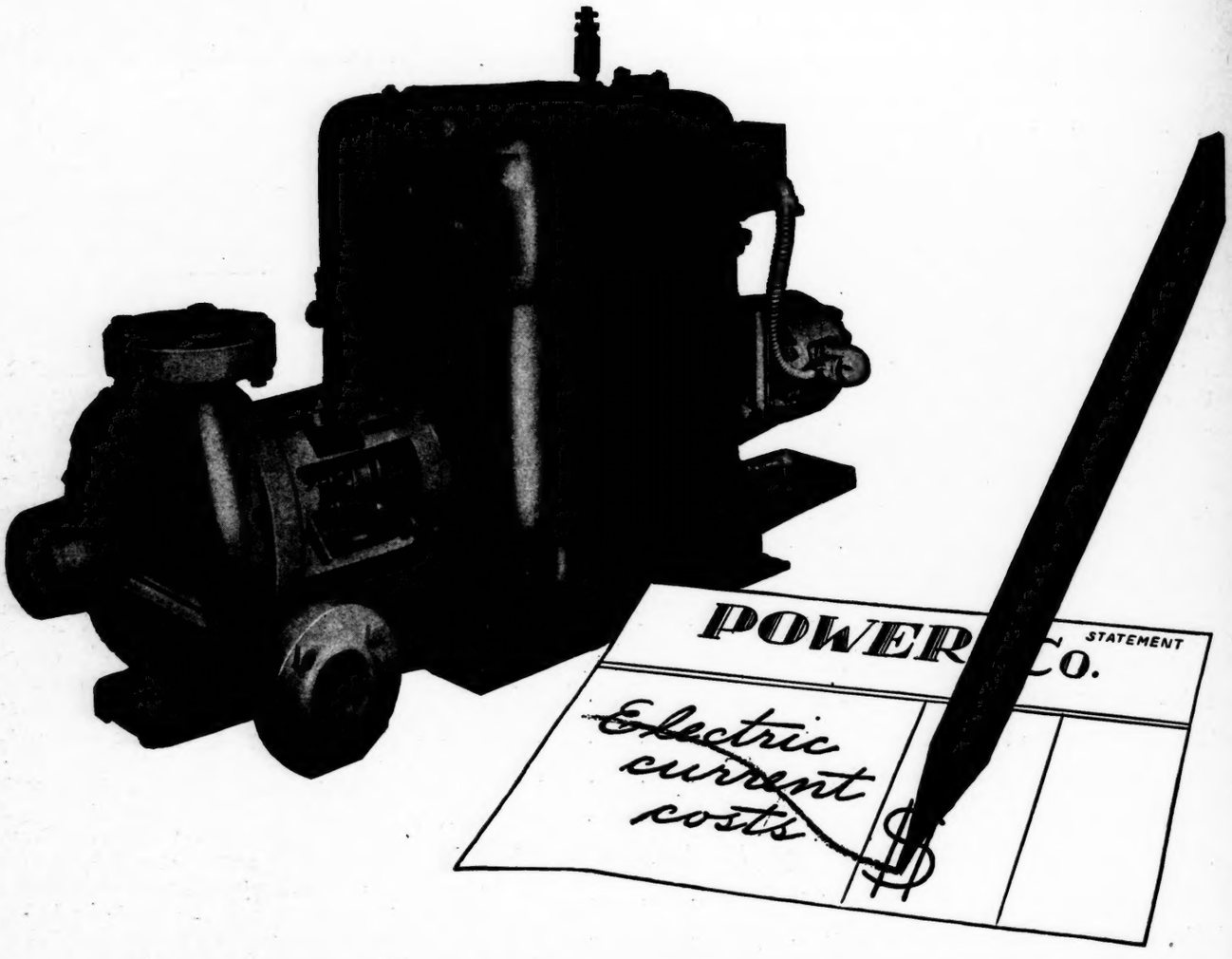
A NASH VAPOR TURBINE HEATING PUMP WILL ELIMINATE THIS EXPENSE ITEM.



The Jennings Vapor Turbine Return Line Vacuum Heating Pump requires no electric current, eliminating the one biggest expense item in the operation of an ordinary return line pump. This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the turbine is returned to the system for heating, with little heat loss.

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This pump has but one moving part, no internal wearing parts, and no internal lubrication. It is compact and quiet, and will give long and satisfactory service at the lowest maintenance cost. Bulletin No. 246 tells all about it. It is free on request.

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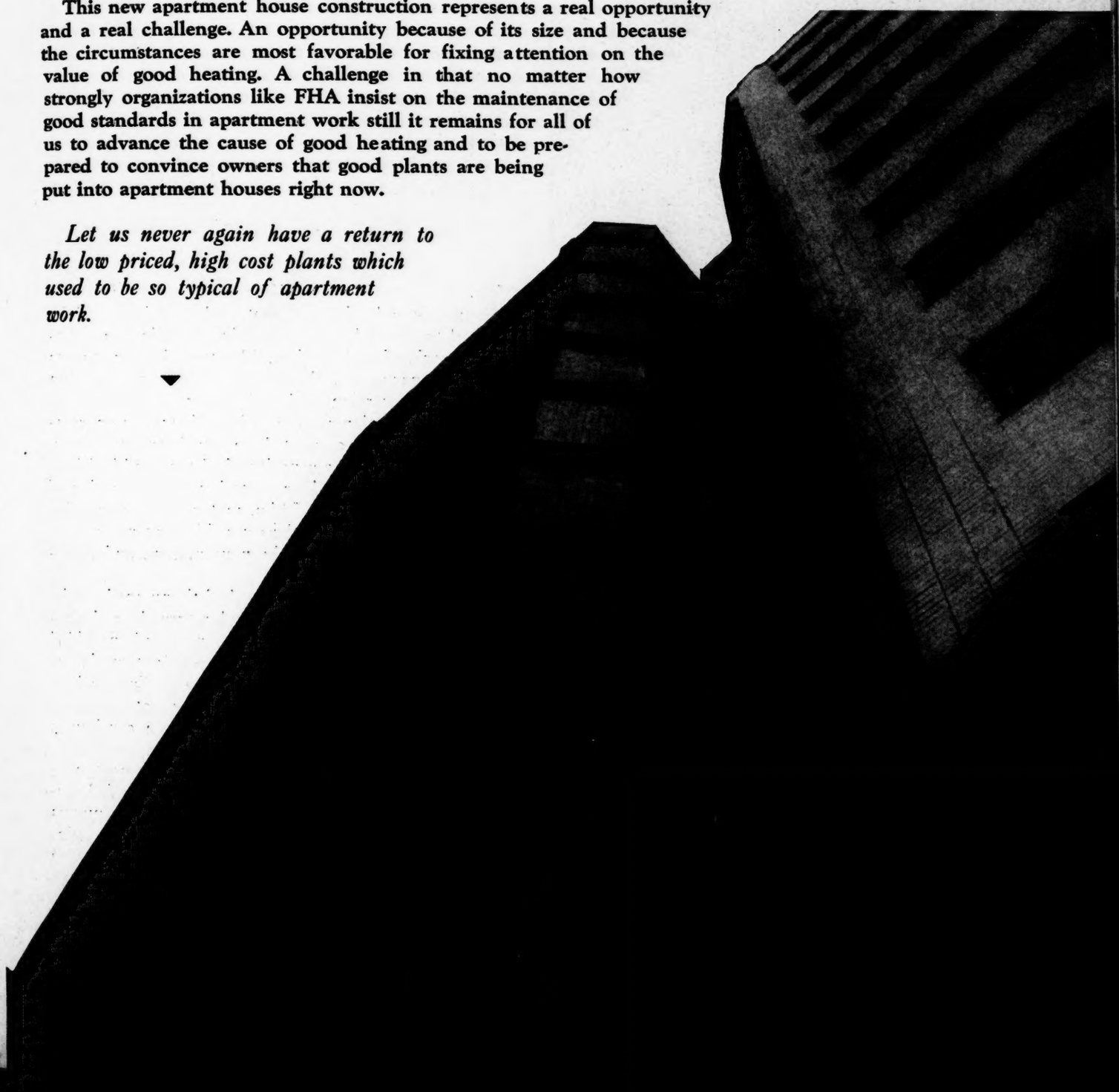
Comfort Plants for the New Apartments

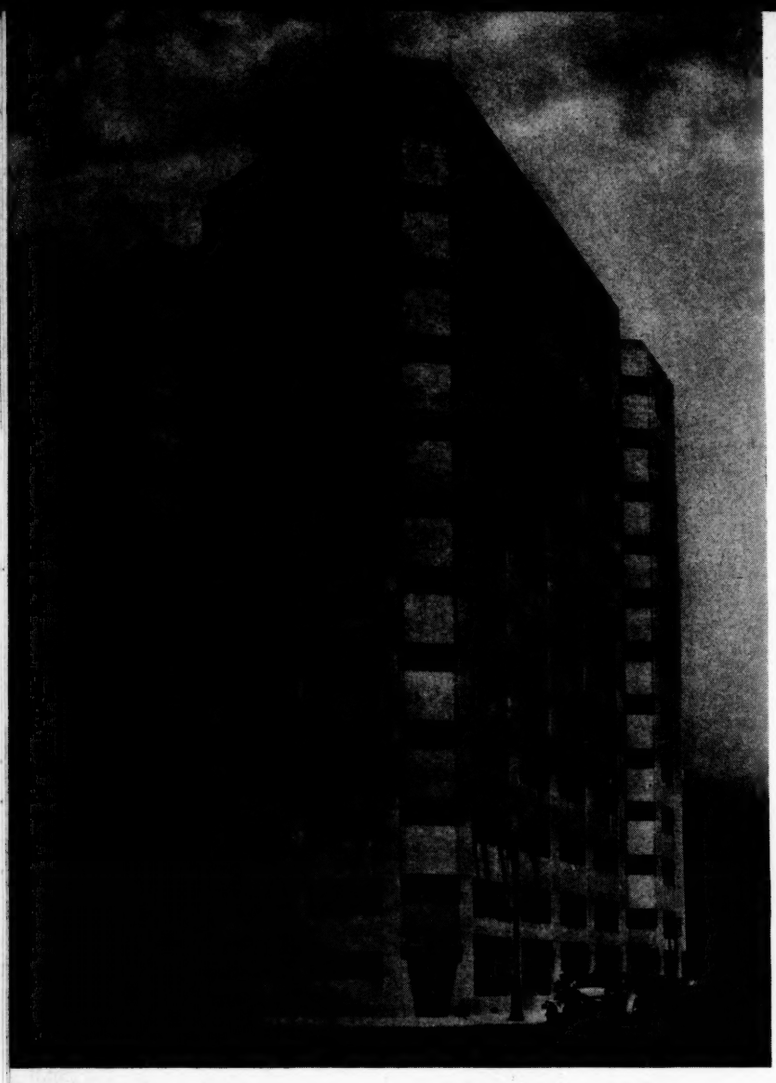
APARTMENT CONSTRUCTION is going places. Not in nearly ten years has there been such activity in erecting new apartment houses. Nor are the new houses like those put up in the nineteen-twenties. Now they are going up for investment purposes and not for quick resale. That puts a premium on operating economy and on continuous occupancy by satisfied tenants. Operating economy demands carefully planned heating plants. Tenant satisfaction demands close control of temperature, and attention to comfort to a degree not required ten years ago. These new-day demands are now being met. To illustrate how this is being done the editors have assembled on the following pages, examples of recent installations, selected to include as many of the newer features as space will permit.

This new apartment house construction represents a real opportunity and a real challenge. An opportunity because of its size and because the circumstances are most favorable for fixing attention on the value of good heating. A challenge in that no matter how strongly organizations like FHA insist on the maintenance of good standards in apartment work still it remains for all of us to advance the cause of good heating and to be prepared to convince owners that good plants are being put into apartment houses right now.

Let us never again have a return to the low priced, high cost plants which used to be so typical of apartment work.



New York's First



25 East 83rd Street, New York—A new and modern apartment house fully air conditioned.

By SULLIVAN A. S. PATORNO†

BEFORE the owners of the apartment building at 25 East 83rd St., New York, decided to make it the most modern that engineering science could do, they were interested in knowing the initial costs of all mechanical equipment, but more particularly the maintenance and operating costs because the plan was to make this operation a twenty year investment. The owners had two objectives:—

1—To make the project so advanced in mechanical equipment and living comfort that it would not be outmoded during its lifetime.

2—To use long life equipment insuring low maintenance and operating costs, as well as continuous service to the tenants.

Hence, complete air conditioning equipment was the first problem of our study.

It was decided to use individual air conditioning units with individual fresh air inlets for each apartment, to prevent mixing air between different apartments. In order to provide continuous air conditioning 24 hours each day, and every day in the year, air conditioning rooms were provided in which the units were installed in such a manner that all parts of the units, controls, valves and piping, could be easily serviced or replaced. These air conditioning rooms are provided on each floor and made accessible only to maintenance men, through public corridors.

A careful study of the performance of the air conditioning equipment during the last 10 months indicates clearly the wisdom of providing separate air conditioning rooms for the conditioning equipment. Periodic cleaning of filters, greasing and oiling of parts, adjustment of valves, and so on have been done without annoying the tenants and in a space where it can be done efficiently. In these machinery rooms all the parts including the risers and horizontal connections are all exposed, making this equipment visible at all times for rapid sight checking.

The building has a gross cubage of 1,100,000 cubic feet. The first floor is used for stores, a doctor's office, the superintendent's apartment, and maids' rooms. The second to eleventh floors, inclusive, contain five apartments each, of various sizes. The twelfth floor consists of three apartments. Above the twelfth floor is a sun room, a games room, and a playroom.

The refrigeration plant consists of two Freon compressors, directly connected to synchronous motors. One compressor has a capacity of 93 tons and is driven by a 100-hp. motor. The second, with a capacity of 47 tons, is driven by a 50-hp. motor. Both plants include a water cooler, condenser, refrigerant pump, motor generator sets for synchronous motors, and necessary controls.

Water for cooling, chilled to 40F, is pumped to the apartment conditioning units and returned to the refrigeration plant at 50F. Each compressor is provided with 50% capacity control with fully automatic sequence operation in proportion to the cooling load on the system. The chilled and condenser water systems have duplicate pumps in order to insure continuous service.

Completely automatic, the heating equipment consists of two cast-iron boilers with No. 6 fuel oil burners. The system has no vacuum or condensate pumps to produce steam circulation. Steam is carried by mains to the steam risers in the air conditioning rooms, then

†Office of Sullivan A. S. Patorno, Consulting Engineers, New York.

Complete Air Conditioned Apartment House

to the heating coil in the air conditioning unit for each apartment.

Cooling service is provided similarly. Water, chilled in a water cooler by the compressors in the refrigeration room, is pumped through mains in the cellar, up through risers in the air conditioning rooms, then through cooling coils in individual apartment conditioners on each floor. The cooling coil conditions the air supplied.

Humidification is effected by means of a water spray chamber in the individual apartment conditioning unit. Water at the proper temperature for spraying is supplied to the unit conditioners from risers in the conditioning rooms.

Cooling is controlled by a summer thermostat which actuates a pneumatically-operated valve, and heating is controlled by a winter thermostat which actuates a pneumatically-operated steam valve. Both thermostats are located in the apartment. The humidity is controlled by a humidistat actuating a pneumatically-operated water valve in the line to the spray chamber. Controls are arranged so that the spray-line valve does not open unless the fan is running. This prevents waste of water in vacant apartments. A summer-winter switch in the apartment determines whether the summer or winter thermostat shall function and prevents simultaneous cooling and heating in the same apartment.

The occupant of each apartment has full control over its air conditioning through an individual set of controls consisting of a summer thermostat, winter thermostat, summer-winter switch and humidistat. The controls and entire system are arranged so that any apartment can receive cooling service while others are being heated.

Each apartment is serviced with an independent floor-type air conditioning unit consisting of a fan motor, steam heating coil, chilled water cooling coil, and copper spray chamber with spray nozzles and air filters. This provides complete air conditioning service, consisting of cooling, heating, humidification and air cleaning. The units were manufactured to meet specified requirements of arrangement and performance for this building, and are not standard commercial units. The servicing required consists of oiling the bearings on the fan and motor and periodic cleaning of filters, simple tasks not requiring specially trained men.

The air conditioning units are located in rooms just off the public corridors, which enables maintenance men to service the equipment without disturbing tenants, and also prevents tenants from tampering with the equipment. These rooms, two on each floor, contain all service lines required for the units, including steam and return lines, chilled water lines, water lines for humidification sprays, drain lines from units for winter humidification, together with the main electric feeders and panels for unit motors. This arrangement enables the building maintenance crew to take care of practically every emergency and eliminates piping, radiators and enclosures in the tenants' rooms.

In the apartments, unit conditioners supply air through diffusing-type outlets with adjustable horizontal face fins. Each room is provided with an independent exhaust register, and an independent fresh air inlet is provided for each conditioner. Air from kitchens and bathrooms is exhausted to the outdoors by exhaust fans on the roof.

It was decided to use a tower for cooling the condenser water for two reasons: (1) to save on the cost of city water for condensers, which amounts to approximately five dollars per year per ton of installed refrigeration, and (2) to forestall costly building changes which would be required if the city authorities were to refuse to allow the use of city water in the event of a shortage. According to the latest available figures on water consumption in New York City, it may not be many years before the situation reaches a point where all air conditioning systems will be required to use cooling towers to conserve the city water supply.

The total tonnage for the refrigeration plant in the building is 140 tons, with a 166-ton cooling tower to

Living room and dining bay in a typical apartment at 25 East 83rd Street, New York. Conditioned air supply outlet is above dining bay at left. Venetian blinds are aluminum to reduce solar heat.

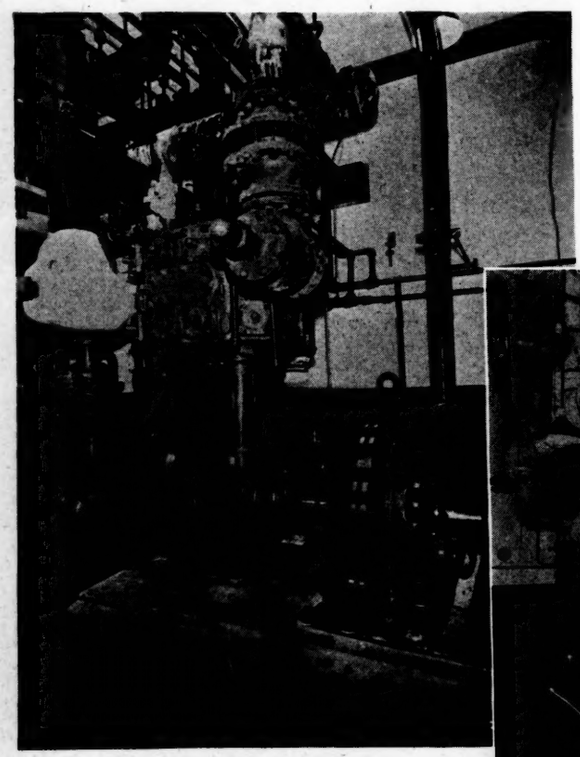
take care of condenser water for future store cooling. The average size of the equipment rooms is 17 ft. by 6½ ft. for three conditioners, and 7 ft. by 9 ft. for two conditioners. Condenser water circulated through the cooling tower and condensers amounts to 450 gallons per minute. Chilled water is circulated through the system at the rate of 450 gallons per minute. The total horsepower for the air conditioning system, not including the standby units, is 223, while the total for the building, not including air conditioning motors, is approximately 36 hp.

Table 1 is a comparison of the initial and operating costs of three types of heating systems, with no air conditioning, and a complete air conditioning system. These costs were carefully studied before it was finally decided to proceed with the installation of the complete air conditioning system in this building.

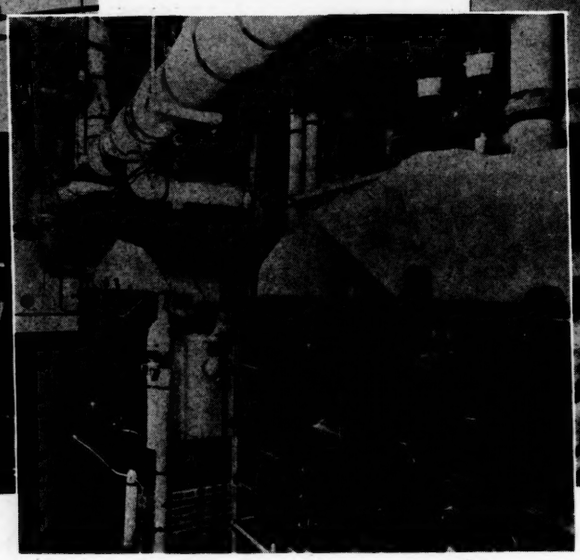
To make this truly the apartment building of the future, the air conditioning equipment is supplemented by the following modern features:—

1—A radio aerial system designed and installed to receive television programs, with outlets in every apartment.
2—Electric ranges and electric refrigerators.
3—No-fuse circuit panels, eliminating the necessity of fuse replacement.
4—Special silent water closets equipped with flush valves and integral silencers.
5—An electric radiator in each bathroom to enable tenants to obtain rapid night heating, when apartment thermostat is set at low temperatures during sleeping hours.
6—New low-type bathtubs.
7—Completely non-ferrous piping, tanks and heaters for the domestic hot water system, with red brass pipes, copper-lined tanks and copper steam coils.
8—Free electric current for ranges, refrigerators, lights and all other household equipment.
9—A completely concealed conduit system, with no exposed bell boxes or telephone wires.

Tenants are assured dependable service by liberal use of duplex units and many duplicate parts. House-water supply pumps, chilled-water circulating pumps are all in duplex. The house tank has two sections. There are two heating boilers, each with an oil burner, affording breakdown service. Spare parts for the unit air conditioners, such as motors, filters, belts, sheaves, spray nozzles, control units and valves, have been furnished as part of the original building equipment. As soon as any part fails to perform properly, it will be



Refrigerating plant in basement supplying chilled water to conditioners. The plant contains two compressors although only one is shown in this view.



Oil fired boilers in basement for heating conditioned air and domestic hot water supply.

Individual apartment unit conditioner in conditioning equipment room. Note insulated fresh air intake duct with damper above canvas collar of intake duct.

replaced by a spare part and repaired at the convenience of the building operating organization.

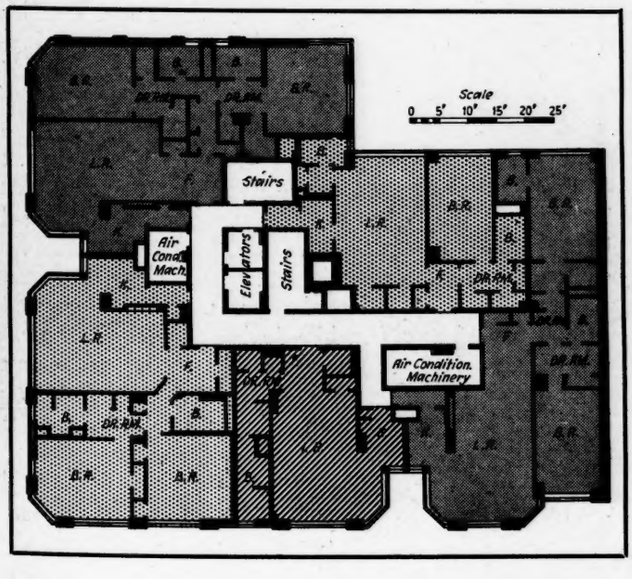
TABLE 1. STUDY OF RELATIVE COSTS OF DIFFERENT SYSTEMS FOR 25 E. 83rd ST.

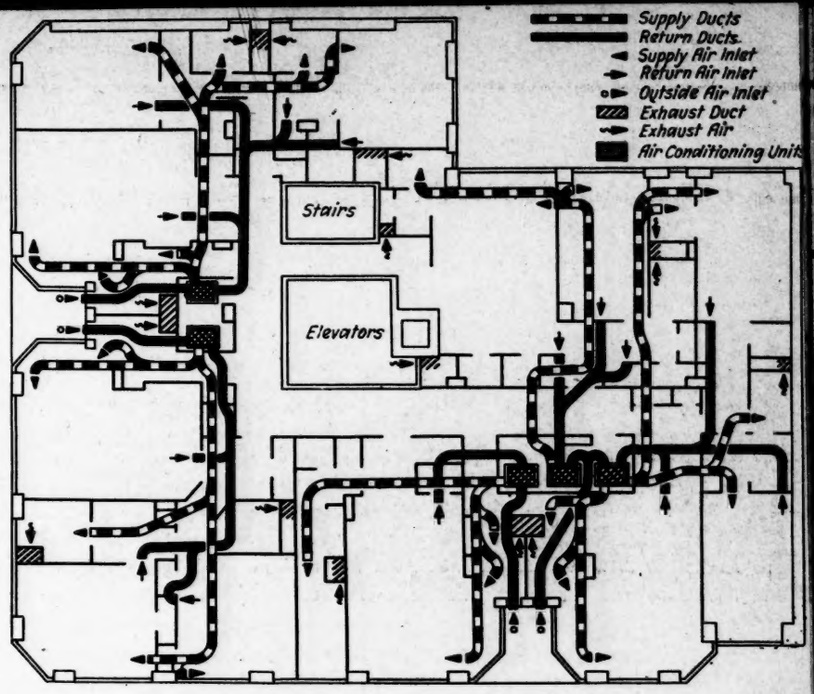
Type of System†	Initial Cost Ratio	Operating Cost Ratio (Fuel) Current and Water
Concealed radiators, exhaust ventilation for kitchens and bathrooms.....	1.0	1.0
Warm-air heating (no humidification), exhaust ventilation	1.06	1.44
Warm-air heating, humidification, exhaust ventilation	1.15	1.72
Complete air conditioning system (no cooling tower)	2.22	3.06*

†Oil Burner included in each case.
*Based on providing 24-hour-per-day cooling service.

Soundproofing, sound isolation and vibration absorption have received much more than the usual amount of attention. All soil lines, waste lines and leaders are covered with sound insulation. Machinery, such as compressors and motors, is equipped with sound isolators and special sound-absorbing foundations. The unit conditioners are completely enclosed in sound-absorbing material, and the motors are isolated from the superstructure of the building. All pipe lines connected to pumps are protected by vibration-absorbing sections. All pipes connected to vibration-generating machines are isolated from the building by special pipe hangers.

On each floor there are five apartments and two air conditioning equipment rooms with service access from the corridors.





Each apartment has its own conditioning unit; its own fresh air intake; and its supply and exhaust duct work.

A careful study of the performance of the equipment in this building since it was completed last summer indicates the necessity of individual apartment controls. Very few tenants are comfortable with the same temperatures in the summer or winter time, and with the same humidity levels. During the winter we have ascertained that some tenants maintain as low as 60F temperature in their apartments during the day time, while others at the other extreme end will maintain as high as 82F during the day time. On the matter of humidity, some tenants have found it most comfortable for themselves at a low level of 20% relative humidity, while others at the other extreme end have maintained from 45% to 50% relative humidity. During the cooling cycle (and in this particular building, the cooling system is operated not only during the four summer months but at any other time when the temperature rises above the comfort zone during the heating season) some tenants have been maintaining temperatures as low as 70F, while others at the other extreme end have been maintaining slightly above 80F temperature. Most of the tenants have been maintaining somewhere in between the extremes. The cooling plant was actually in operation during warm spells in the months of October and November 1938 and the beginning of May 1939. The heating system was actually in operation during a few of the chilly summer days of 1938. There were very many days when it was necessary to have the heating and cooling systems operating simultaneously, because of the comfort requirements of different tenants; some very definitely felt comfortable with the heating on, while others would not have felt comfortable unless the cooling system was in operation.

Heating in Richmond Garden Apartment Controlled by Varying Steam Temperature

The Lock Lane Apartment in Richmond, Va., includes in its steam heating plant such features as day and night temperature control, a bin-feed automatic stoker, a differential vacuum system, together with other modern facilities such as electric washing and drying rooms in the basement for tenant use.

NO more than a look at the photograph is necessary to see that the Lock Lane Apartment is unusual. It consists of twenty-four 4½-room apartments with two bedrooms, bath, living room, dinette and kitchen; and also of eight duplex houses. In the photograph the duplex houses, being finished in white, stand out while those parts of the building which contain the usual apartment quarters are constructed of red brick. It will be noted that the two end units are ell shaped and are each two stories in height. Each of these end units has six apartments. The eight duplex apartments are housed in the two-story buildings and are arranged so that four of these apartments are made up of living room, dining room, kitchen, two bedrooms, and bath, while the other four are similar except that they have three bedrooms each. The house is located in open surroundings and is of the garden or, the horizontal, type.

In so modern a plan it is only natural to expect to find that a modern heating plant is included. There is one central plant which supplies steam heat to the whole project and this plant is located in the basement at the center of the group. The stack rises only a little above the roof of the central three-story unit and consequently does not present an unsightly appearance.

The whole house makes available living quarters for 32 families, and 178 direct radiators are installed. The rated surface of the radiators is nearly 4400 sq. ft. Additionally there is a 1000-gal. hot water generator having a recovery of 400 gal. per hr. with a 100-degree temperature rise. The water is heated from the boiler using a submerged heater controlled by an aquastat and making use of a circulator. To handle this combined load there is one boiler which during the winter is operated at a pressure of from 2 to 4 lb. while during the summer a temperature of 190F is maintained in order to permit satisfactory heating of the service hot water. Boiler is of the horizontal return tubular steel type and is fired by a bin-feed automatic stoker.

The heating system is two-pipe with a differential vacuum so arranged that the temperature of the steam

in the radiators can be varied over a wide range as the outside temperature changes. Fractional heating of the radiators is also possible with this method. Fig. 1 shows in diagram the principal parts of this steam system. Steam passes through the motor control valve in the main and is then fed to risers and into individual radiators in each room. Radiators have a regulating device at the inlet while the return lines are equipped with a thermostatic trap which passes condensate and air to the return risers and thence into the return mains. Mains discharge to a condensate receiver and through a vacuum pump back to the boiler. The pump operation is controlled through a control device which operates to keep the pressure at the pump somewhat less than the initial pressure near the main control valve. Action of this pump is intermittent under the influence of this control. The position of the valve stem in the main motor operated valve is fixed by a valve controller which is under the influence of both the heat demand from the building and of a temperature sensitive bulb located on one of the radiators. The result is that the valve is subject to the load on the building, the temperature condition in the system, and to the action of 4 thermostats located in various selected rooms in the building. The whole plan thus permits maintenance of suitable room temperatures regardless of fluctuations in outside temperature and does this under automatic control although provision is made for manual operation when desired.

Construction of this building was started in May, 1938 and it was completed on Aug. 31, 1938. The heating system was placed in operation, following its testing and cleaning, on Sept. 1, 1938, and has been in constant operation since that time. Since that time too all apartments have been occupied and heated and the operation calls for the maintenance of a day temperature of 72F from 6 a.m. to 11 p.m., and a night temperature of 66F from 11 p.m. to 6 a.m.

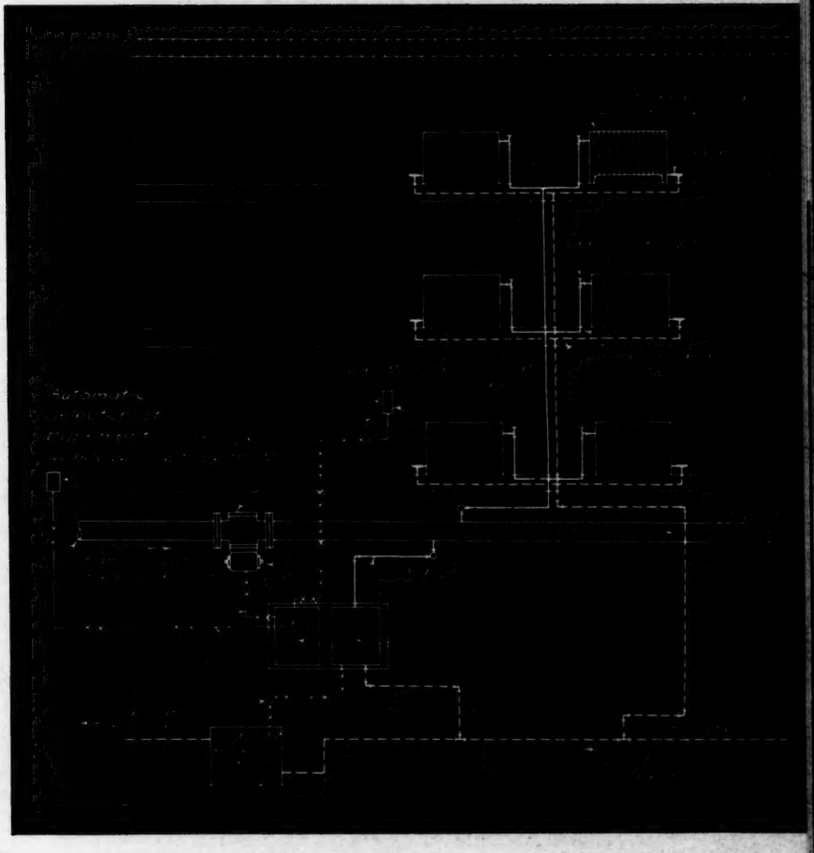
Operating results from the time the system started up to May 1, 1939, indicate that for the period in question the normal degree days are 3725 while the actual degree days have been 3415. It will thus be seen that the season during which this plant has been in operation has been somewhat warmer than a normal season. It is reported that during the same time approximately 115 ton of coal have been purchased and used in the building. This coal has been used not only to supply the heat for the 32 large apartments but also to keep the tenant demand for hot water fully supplied.

The heating installation in the Lock Lane was installed by W. W. Ellett; Carl M. Lindner was the architect; the heating plant design was by Pelouze Sales Co.; while the owner of the building is Colonial Homes, Inc.

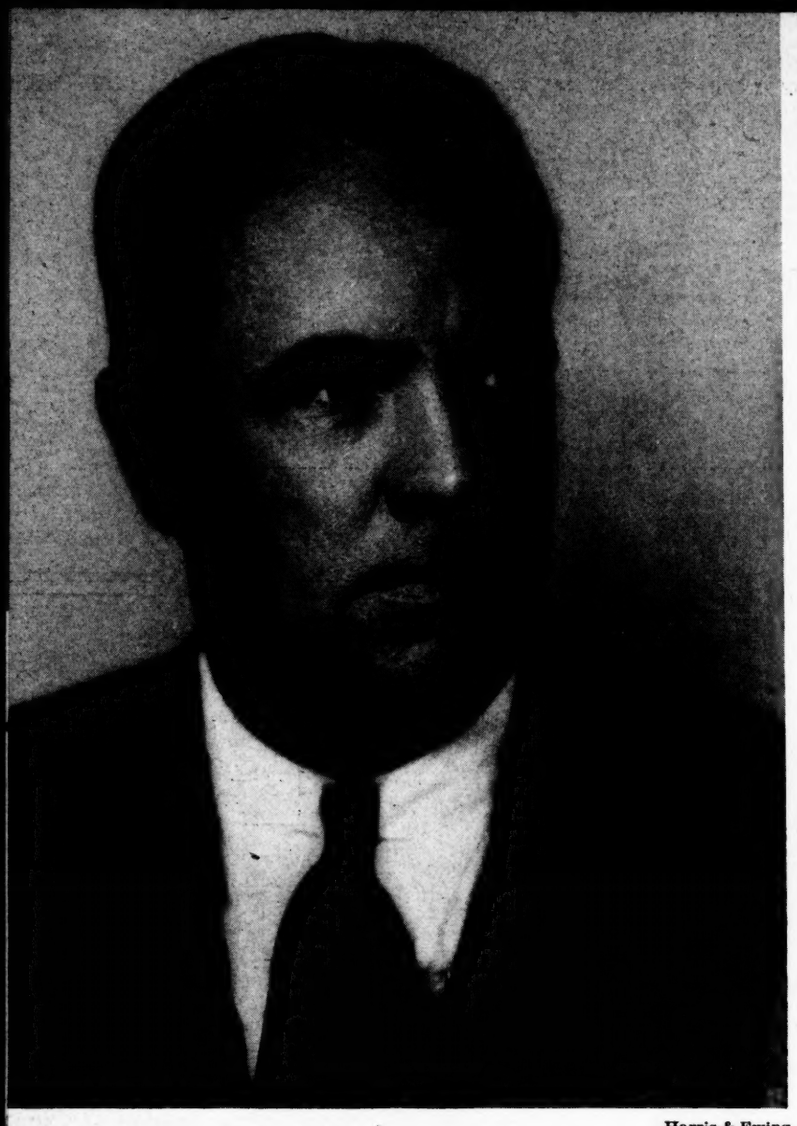
TABLE 1—RECORD OF ACTUAL AND NORMAL DEGREE-DAYS EACH MONTH FROM SEPTEMBER, 1938 TO MAY, 1939

Month	Degree-Days		No. of Days
	Normal	Actual	
Sept. 1938	...	31	30
Oct. 1938	158	198	31
Nov. 1938	483	409	30
Dec. 1938	765	747	31
Jan. 1939	825	697	31
Feb. 1939	702	548	28
Mar. 1939	552	502	31
April 1939	240	283	30
May 1939	...	...	31
Total	3725	3415	273

Fig. 1. Diagram showing principle of heating system with typical riser and radiators in middle unit, elsewhere building is two stories.



Trends & Tendencies Opportunities for the



Harris & Ewing

During the past five years plans for heating approximately 50,000 apartment dwelling units costing $250 millions have passed across the desk of the author. In this article he explains the Federal Housing Authority's requirements for heating this type of building, reviews some of the more outstanding tendencies in heating of these buildings and discusses the opportunities for the consulting engineer in this field.

By R. K. THULMAN†

SINCE the passage of the National Housing Act in 1934, the Federal Housing Administration has reviewed and insured the mortgages of many large-scale rental housing projects built in many cities. In all of these the heating system is an important item of equipment. Many of the heating installation problems presented by this type of operation are more or less unusual and varied in nature. Observation of the heating systems in use or suggested for these housing developments has indicated certain trends in engineering practice and technique. A close-up of the picture also indicates the opportunity which these housing projects offer many heating engineers.

The Rental Housing Division of the Federal Housing Administration operates under Section 207 of the National Housing Act as amended February 3, 1938. Section 207 authorizes the insurance of mortgages not in excess of $5,000,000 each on privately constructed and financed rental housing projects. These mortgages are fully amortized during their term and bear interest at a rate not in excess of 4½% per year. The owner-corporations are regulated by the Administrator as to capital structure, charges, rents, rate of returns, and methods of operation.

Under Section 207 as well as Section 203 (which deals with the insurance of mortgages on one to four-family residences) the Administrator must find prior to insurance that the project, with respect to which the mortgage is executed, is economically sound. Further duties as described in the preamble to the Act are the encouragement of improved housing standards and conditions and the encouragement of mortgage financing as an aid toward improving conditions of the construction industry.

Since the cost of heating frequently represents the largest single item of operating cost, it is important that projects submitted to the Rental Housing Division for commitment for mortgage insurance include efficient and adequate heating systems. The Federal Housing Administration does not write specifications, plan heating installations, nor does it have a standard specification for this type of project.

Basic Heating Requirements

As a result of experience gained in the study of, and actual operation of completed rental projects, certain

†Mechanical Engineer, Federal Housing Administration, Washington, D. C.

in Heating of F.H.A. Rental Projects and Heating Engineer's Talents in this Field

basic requirements for heating systems, however, have been developed. These requirements are based upon performance or the accomplishment of a desired result rather than specifications dictating what type of system shall be used or how it must be installed. Many of these requirements are elementary, but are desirable as a working basis. For instance, it is obvious that every living unit in a rental project should have facilities for heating designed in relation to local climatic conditions. It is obvious also that the degree of refinement of the heating system should be related to the rental level of a particular project. When this factor is overlooked by designers, the result too often is a system that is too costly for a low rental project or which lacks the refinements demanded by tenants in a project intended for a higher rental level.

A safe heating installation is a fundamental requirement. To accomplish this objective, it is required that systems comply with local laws and ordinances and the recommendations of the National Board of Fire Underwriters, and with the instructions of the manufacturer, except where these instructions conflict with other governing regulations.

As a basis of capacity it is stipulated that the heating system shall be designed to maintain a uniform temperature in all habitable rooms of 70F. whenever the outside temperature is between 65 and 15 F. above the lowest temperature ever recorded for the locality. The uniform temperature requirement permits a variation of not more than 2F. from room to room in living units.

When a project is designed so that heat is included in the rent, it is required that control of the system shall be automatic and preferably by variation of the heating medium, whether air, water, or steam, rather than by variation of the time during which the heating system is on or off. The performance desired is a continuous or nearly continuous output in accordance with heating demand.

The only other specific requirement is concerned with air heating systems in which air is recirculated. In this case none of the air recirculated may be collected from any other living unit except from the one supplied.

Types of Heating Systems Submitted

Naturally, when projects built in all parts of the country are designed by different architects and engineers, there is bound to be a wide variety of ideas proposed for heating. Most of the early housing developments submitted to the Federal Housing Administration included heating systems of the central station type with a relatively elaborate boiler plant and considerable underground piping. Temperature control in such systems was usually of the manual type. In many instances there was considerable overheating and an extravagant use of fuel.

Experience with the central plant indicated that its justification was a matter of concentration and distribution of the heating load over the plot area and the ratio of underground piping to the units of heating load. Each job is a more or less individual problem and as such requires individual study and treatment. When the cost of underground piping becomes excessive it is evident that the central plant is not economical. On the other hand, the cost of a number of small chimneys and boiler rooms for a group of semi-central treatment may exceed the cost of the single stack and boiler room. There appears to be no workable formula, even an empirical one, which can be applied to the problem. A preliminary study of each project is advisable to determine the most suitable method of heating from all standpoints.

When group plants are decided upon, the cost of maintenance and attention may usually be reduced justifiably by including automatic firing equipment. The temperature control equipment problem also is simpler and often less costly in the group method.

Among the many varieties of heating systems submitted for use in large-scale rental housing projects, several sponsors have proposed the use of individual unit air heaters. Market acceptance of unit air heaters in the housing field, however, has not been established. The advisability of their use is, therefore, problematical at present. More information on this type of system also is needed to indicate its advantage from the standpoint of economy of installation, maintenance and operating costs.

The type of house plan used on the project is an important factor to be considered in connection with the selection of unit air heaters as the heating system. When living units are designed vertically, that is, as in the case of the detached or row house, when an individual plant may be fired on the first floor or in the basement, any type of fuel economically available in the locality may be used. Where the plan is based upon living units on a single floor as in the case of the typical apartment building, limitations are imposed on the type of fuel which can be satisfactorily and conveniently adopted.

Since the future is always unpredictable, it would appear advisable to use unit air heating systems only

under conditions which do not limit the type of fuel which can be used and to design them for future conversion to another type of fuel should this be necessary. The design problem could be solved by the use of units incorporating an indirect heat exchanger using steam or water as the heating medium. For unit application the heat exchanger could be connected to an individual water heater.

When unit systems are used in rental housing projects, it is essential to consider the question of correct size fans and their installation to minimize noise of operation. The probability of continued stability of the price of fuel should be weighed as well as the relative cost of different fuels. In certain instances, the disadvantage of a gas rate higher than other fuels has been offset by the advantages of individual metering. This has been due to the opportunity for tenants to effect economies by controlling the temperature of their own living quarters in accordance with their needs and desires. However, where heat is included in the rent, a real incentive on the part of the tenant to economize does not exist.

A number of projects have been designed with central or semi-central systems of air heating. Duct systems present several problems that either make them objectionable to use or costly to install in multi-family structures. These deal particularly with the distribution of kitchen odors and the possibility of infection in the case of air-borne diseases. When duct systems are used, the Rental Housing Division Standards do not permit the recirculation of air from more than one living unit. Central systems using air as a heating medium have advantages and it is believed that such systems may be developed to overcome present disadvantages. Efficient and economical deodorizing units and purifying devices would do much to increase acceptability. The development of an efficient and quiet operating air moving device would likewise contribute to favorable consideration especially since air conditioning is recognized as having, in many instances, important rental appeal.

Hot Water Heating

About 35% of the projects either completed, under construction, or on which commitments have been made are heated by hot water heating systems. In most cases where hot water has been specified, room temperature is controlled by means of modulation of the temperature of the water delivered to the radiators in accordance with the heat losses. This method is relatively simple with water. Most of these systems require forced circulation because of the long pipe runs involved and pump operating is either continuous or nearly continuous. One of the objections to the hot water heating system is the frequent necessity of venting air from the radiators. This objection has been overcome in certain projects, where the construction permits, by extending the heating main riser to the attic space and providing a downfeed distribution with a basement return system. The high point of the main is vented automatically.

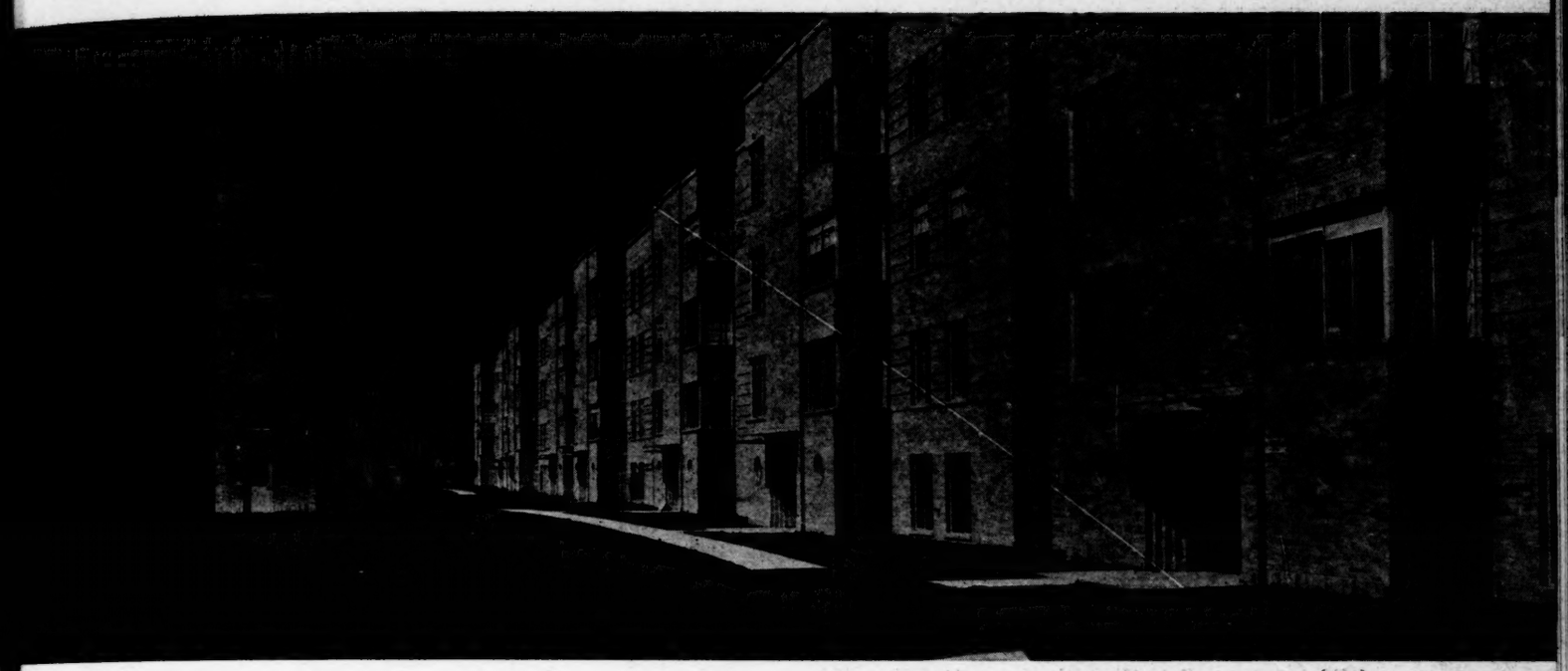
In the field of steam heating, many varieties of systems have been submitted. The Federal Housing Administration has consistently recommended that such systems be equipped with control devices and that such systems be equipped with high vacuum pumps or with metering devices which would control either the temperature of the steam or its volume in accordance with the demand.

In seeking to encourage improvement in the development of the systems of heating, the Federal Housing Administration, through its Technical Division, has endeavored to express minimum requirements and minimum standards in terms of performance rather than by definite specifications. Such minimum requirements are flexible in relation to the character of the project so that freedom may be given to the development of low cost housing projects unhampered by too highly restrictive requirements for heating.

There can be no question that there is an opportunity for the professional heating engineer in the field of rental housing projects. The preparation of complete heating plans as a result of thorough study of the requirements of the project, and an analysis of the economics of that project by a competent engineer, together with his supervision during construction, would do much to assure the Federal Housing Administration of the soundness of the security back of the mortgage which it insures.

Although the average rental housing project may involve merely a large scale residential heating system, there is ample opportunity for improvement in technique and in the development of new ideas in heating in this field. It should engage the attention of the engineering talent in the field of heating and ventilating, and thus provide an opportunity for constructive and profitable work.

Convectors Save Wall and Floor Space



ALTHOUGH living in a residential district surrounded by tree-lined streets, the 147 families in the new Wolcott Apartment are still less than a half hour from the Chicago loop district and are close to shops, churches, parks and lakeshore beaches.

This exclusive apartment development occupies the entire block on Wolcott Avenue from Ainslie to Argyle Streets fronting nearly 650 ft. on the avenue and extending to about 200 ft. along the streets. The buildings are so designed that they surround practically the whole plot leaving large open spaces at the center which are carefully landscaped thus producing the advantages of a private park.

The group consists essentially of a series of structures of similar plan and design placed side by side, each of three stories and English basement. Constructed of buff colored brick with modern functional lines the whole group of buildings presents a striking appearance.

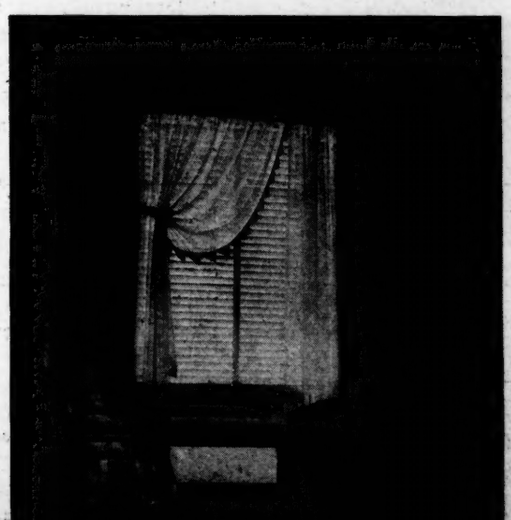
Inside there is the same impression of modernity as the large rooms are arranged with large unimpaired wall spaces and with angle steel-sash windows in all living rooms. Every attempt has been made to make the apartments attractive to the eye as well as livable and comfortable for the tenants.

As is to be expected the heating plant is also modern. A two-pipe reverse return forced flow hot water system is used. In its design the heating surface was proportioned on the basis of a 220F average water temperature. On this basis over 24,400 sq. ft. of radiator surface is installed. The plant is stoker fired with the stoker under control of boiler aquastats. The entire installation is subject to the action of an outside temperature control so arranged that this control operates to start and stop the pumps. Domestic hot water is supplied from indirect submerged heaters.

In keeping with the desire to have unobstructed floor space convector type concealed radiators are used. How well these heating units have been worked into the general design of walls and furnishings is well illustrated in the accompanying photograph.

No mechanical cooling for summer has been provided for but the plot plan makes use of the principle of obtaining cross-ventilation in each apartment. Moreover, to insure summer comfort as well as to conserve winter fuel the roof has a 4-in. covering of heat insulating material.

Architect is Christian S. Michaelsen, Chicago; heating engineers and contractors, William V. Hoier & Associates, Chicago; managing agents, Ray W. Summe & Co., Chicago; and builders, M. J. Boyle & Co., Chicago.

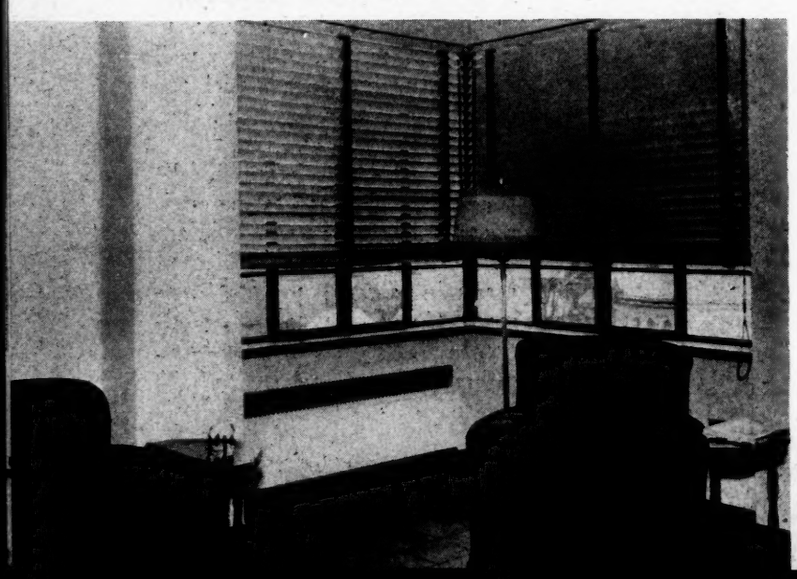


A Modern Low Pressure Two-pipe System in the New Riverview Terrace Apartment

Modern low-pressure steam heating with orifices, central throttling control and concealed convector heating units is playing an increasing role in privately financed new apartment construction. In Charleston, W. Va., the Riverview Terrace House incorporates these features together with an automatic gas-fired boiler plant and independent gas-fired heaters in all bathrooms

AS an example of how a modern apartment located in high-class, pleasant surroundings can enjoy the benefits of a thoroughly modern steam heating system, it would be difficult to find a better case than that of Riverview Terrace Apartments in Charleston, West Virginia. This house, with six full stories and two stories on a setback, is attractively finished in modernistic style with light brick and steel sash. The front entryway, reception rooms, and the wide terrace in front add to its attractiveness. The house provides quarters for 48 families. This installation shows that it is possible to keep the heating plant within the first cost limitations necessary for investment return and at the same time provide such features as concealed radiation and comfort control, usually associated only with highest cost types of construction. The installation contains 5,866 sq. ft. of heating surface in living room, dining rooms, bedrooms and public rooms, supplied with heat through a two-pipe low pressure steam distribution system. Through the use of orifices and a central throttling steam control the flow of steam to the heating units is varied for changes in outdoor temperature and weather conditions.

Fig. 1. The fully recessed convectors take up no usable floor space, while grilles present an attractive appearance. Heating elements are removable through lower grille opening for repairs and cleaning.



Concealed Radiators are Used

In keeping with the modern thought regarding heating surfaces in apartment buildings, radiators are of the concealed type fully recessed into the walls, thus avoiding the necessity of using available floor space in the rooms. The recessed convectors are built of non-corrosive material and a thermostatic trap and a supply valve with a suitable orifice are built into the headers. Convectors are for gravity air flow and openings are provided at the floor level and a grille opening is located above the heating surface. Cast-iron radiators of conventional design are used only in the basement of this building.

Independently operated gas-fired room heaters are located in each bath room throughout the building, thus permitting heat in these rooms entirely at the tenant's choice.

Fig. 6 is a diagrammatic view showing the principle involved in securing proper heating in Riverview Terrace. It will be noted that steam from the gas-fired boilers passes through the throttling type steam control valve where the valve stem is positioned in accordance with variations in the outside temperature.

This system is so designed that for any given outside temperature a definite steam pressure is maintained on the system.

Boilers are operated at low pressure and the only reduction in steam pressure necessary takes place as the steam passes through the control valve. It is then conducted through upfeed risers to the concealed convectors located in each room of the building. Return risers bring the condensate and air back to a return

Pipe Steam System Charleston, W. Va.

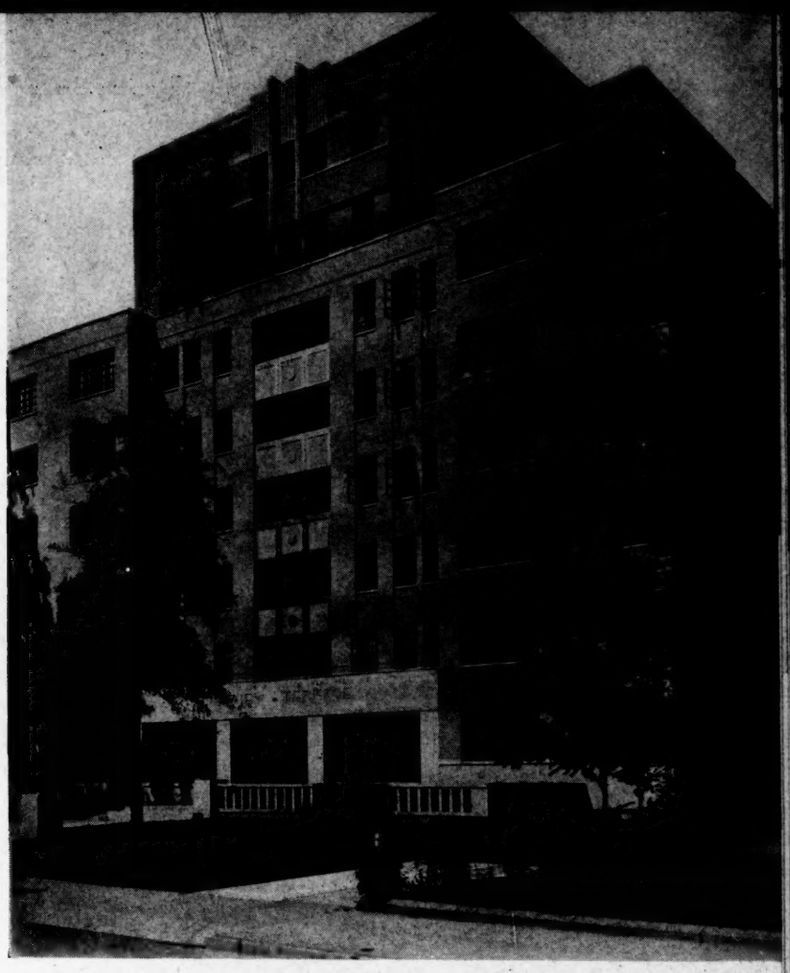


Fig. 2. The eight-story Riverview Terrace Apartment in Charleston, W. Va.

line which, by gravity flow, conveys the air and water to the condensate pump and receiver in which the air is expelled from the system and the condensate is returned to the boiler.

An interesting feature of this installation is the provision of all-pipe expansion loops in the fifth floor with the vertical piping anchored at suitable locations.

All risers and their branches are carried concealed in side walls and floors. Special care was taken to see that piping does not rub on construction in order that its proper expansion may not be interfered with. All piping is substantially supported. Conventional practice of using gate valves as shut off valves with globe valves for throttling is followed. All exposed hot surfaces in the boilers, hot water storage tank, boiler breeching, and on the concealed piping and basement supply main, are covered with insulating material.

Two steam boilers each rated at 6080 sq. ft. of equivalent direct radiator surface having 43½ cu. ft. of furnace volume each and 358 sq. ft. of heating surface are used as a source of steam supply. Boilers are constructed for 15 lb. working pressure while a pressurestat is used to control the gas burners. Boilers are gas-fired with multi-tube burners. Combustion spaces in the boilers are brick lined. Additionally to insure safe operation each boiler is equipped with a boiler protector with low water cut-off, while the conventional Hartford loop connection is used in connecting the piping to the boilers. A fan located in a small penthouse draws air through exhaust flues from all the inside toilet rooms.

In order to insure an ample supply of service hot water a horizontal storage water heater is installed on

Fig. 3. The control cabinet—heart of the control system—shown mounted on wall near control valve.

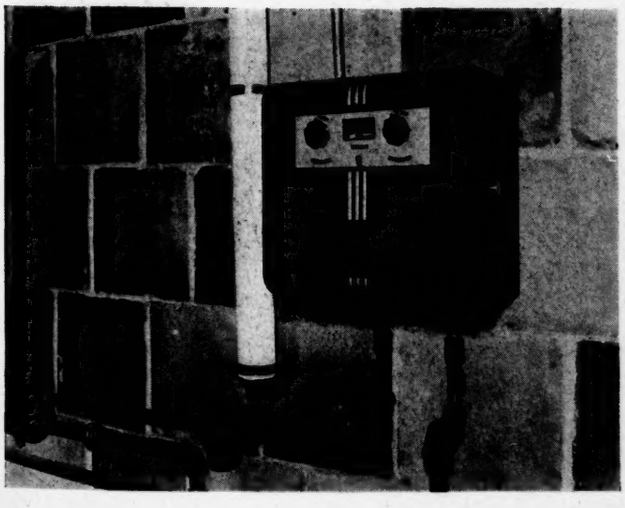
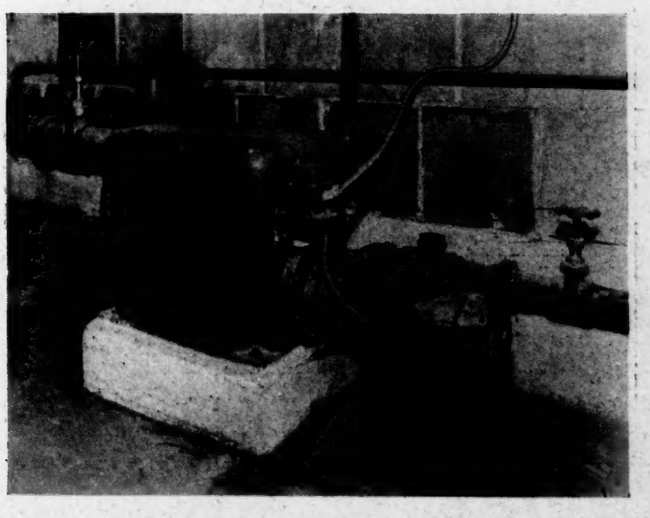


Fig. 4. Receiver and condensate pump permit return of condensate to the boiler after separation of air and gases.



saddles close to the boilers. This tank provides a storage capacity of 1000 gal. of water heated directly by gas-fired equipment operating under control of a temperature regulator set to maintain a steady water temperature in the storage tank.

Architect of the Riverview Terrace Apartments was Walter F. Martens, Charleston. Heating contractors were Meyers Brothers, Charleston.

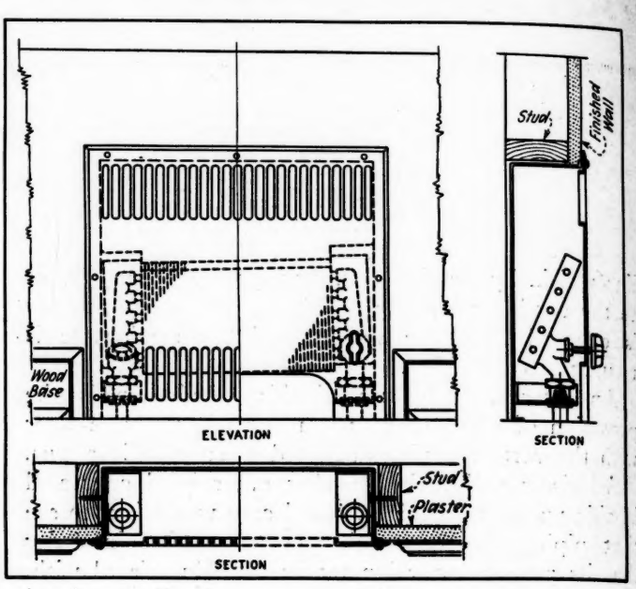


Fig. 5. (above) Sketch showing arrangement of the convector heaters. Valve with orifice and trap are built into the supply and return headers respectively.

Fig. 6. (below) Diagram showing arrangement of piping, control equipment and a typical flow and return riser.

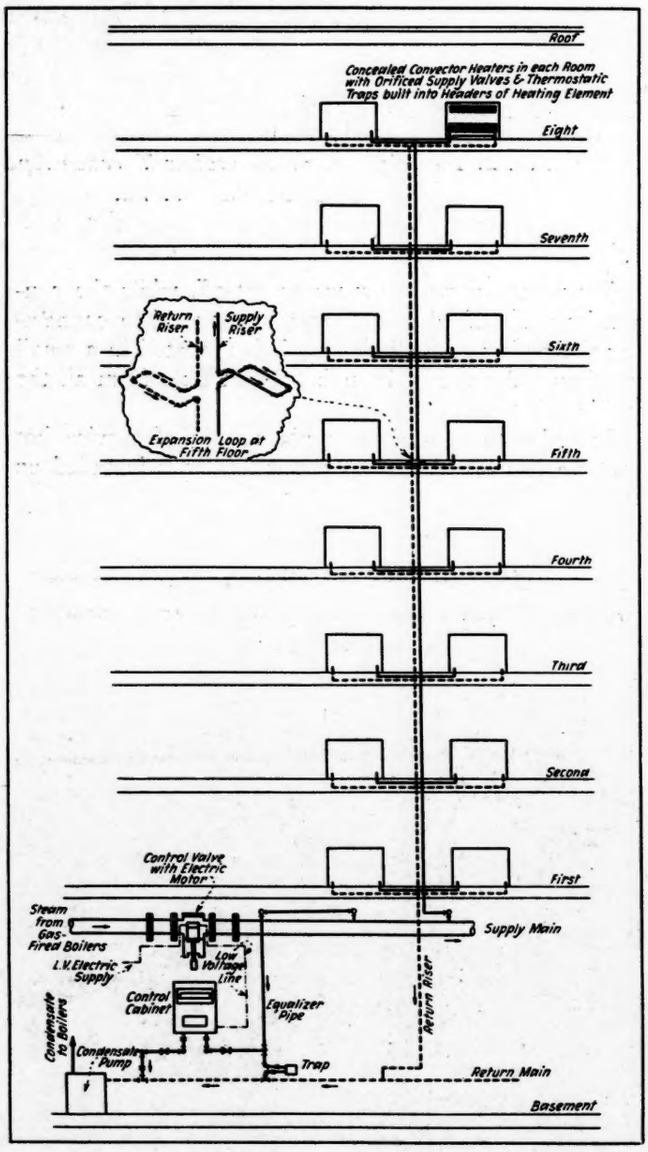
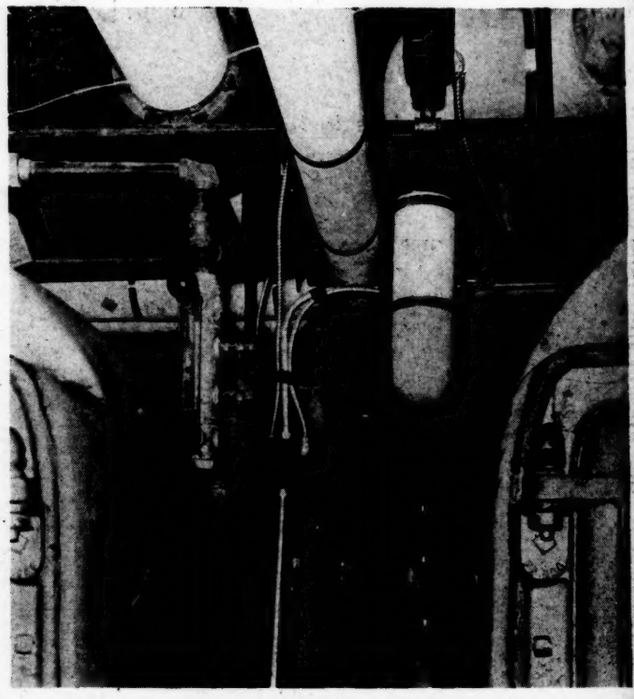


Fig. 7. (below) Piping and equipment between the two boilers. Boiler protector and pressure-stat add to operating safety. Control valve motor visible in upper center.



Garden Apartments Select Convectors

MEADOWBROOK VILLAGE, located on East Front Street in Plainfield, N. J., is an excellent example of what the modern garden-type apartment can be like.

It consists of 31 colonial brick buildings, arranged in 7 groups, having 180 apartments, and a total of 716 rooms. It was constructed on a beautifully landscaped private estate, with the buildings occupying less than 20% of the land area. A feature of the project is an outdoor swimming pool for the use of the tenants. The project was conceived by Harry A. Taylor, President of Frank H. Taylor & Son, Inc., Note First Name, sponsors and managers of Meadowbrook Village.

The suites range in size from three to five rooms, and there are no inside or court apartments. They contain numerous modern features of construction and equipment, and the project is proclaimed by many housing experts as one of the finest examples of garden apartment projects in America.

All rooms and halls are heated by concealed, wall type, non-ferrous convectors. This type of heating surface was selected primarily because of its neat appearance and space saving features, as well as because of its advantages when used with hot water heating systems. How well the convectors fit in with the general design of the room can be seen in the illustration.

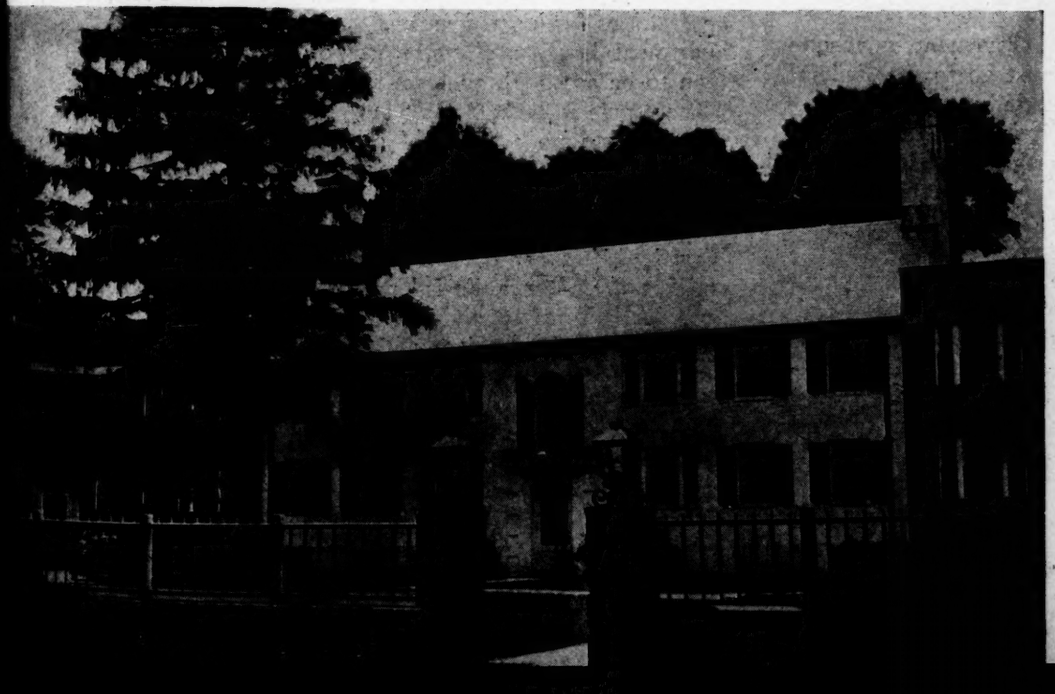
Heating is accomplished by heating plants in each building group—three of the larger groups having two plants each while the other four have one plant each. There are ten plants in all and they are practically identical as regards to heating equipment.

Each plant has a single, oil-fired, steel boiler for supplying both the heating and domestic hot water systems. The oil burners use No. 5 fuel oil which is stored in an underground tank close to the boiler room.

Water for heating leaves the boiler through a single main, flows to the various convectors and is then forced back to the boiler by a circulating pump in the return line. Domestic hot water is heated by a coil submerged in the boiler water and is mixed with cold water by an automatic tempering valve. A circulating pump on the domestic hot water line serves to keep the water in the pipes hot at all times.

It is interesting to note that all of the smaller pipes in the heating system and all of the pipes in the domestic hot water system are of copper with sweated fittings.

Each heating plant is controlled by two thermostats located in the halls of the buildings. These thermostats control the operation of the heating system water circulator while the oil burner and the temperature of the water is controlled by a water temperature control submerged in the boiler water.



(Above) A typical living room showing wall type convector beneath window. Sweated copper tubing is used to carry the hot water from the mains to the convectors.

(At left) One of the groups of apartments in Meadowbrook Village, Plainfield, N. J. This particular group is heated with two separate heating plants.

Apartment Construction Most Promising Feature in New Building Outlook

By L. SETH SCHNITMAN†

THUS far in 1939 no other major productive pursuit has shown the stamina and recovery powers of residential building. Where recurrent tensions on the international scene have left tell-tale traces on most important lines of domestic enterprise, residential building has managed to reach a higher level of new undertakings than has been seen at any time since 1929.

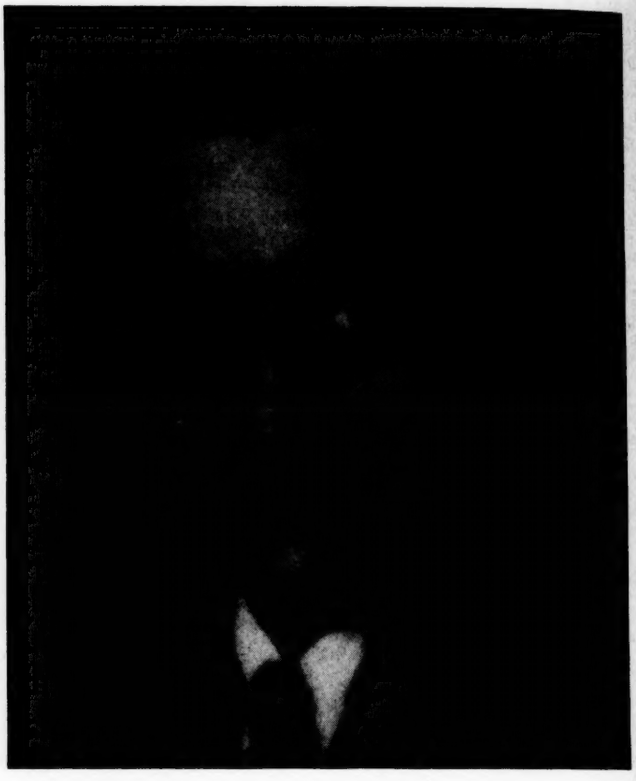
Taking the figures of F. W. Dodge Corporation as a yardstick, housing projects started or placed under contract during the initial five months of 1939 amounted to $533,000,000; this represented an increase of 70% over the total for the corresponding period of last year. And out of the five-month total for 1939 roughly 90% represented private commitments as differentiated from public housing.

For multiple-family housing alone, the construction performance thus far in 1939 has bested that for residential building as a whole. And this is distinctly encouraging in that it represents a growing interest of investment capital in the sphere of rental housing. Out of the indicated residential total for the half-year not far from $160,000,000 will represent the volume of apartment house construction undertaken in the 37 eastern states, a volume more than twice as great as the corresponding total for the first six months of 1938. When completed the apartment houses here considered will have provided for some 44,000 family dwelling units, likewise more than double the total in the like 1938 period. True it is, some of this gain is due to public housing projects undertaken chiefly by the United States Housing Authority, for some $65,000,000 of the estimated half-year apartment house total of this class of housing will have gotten into the records during the period. Yet it is likewise true that the bulk of the half-year's apartment house total will represent private projects.

Much of the credit for the improvement in private apartment house construction must go to the Federal Housing Administration and especially to the National Housing Act, Section 207, for it is under the liberal credit terms and guaranteed mortgage features of this provision that previously timid construction capital has been made to flow more freely.

Through April 30, 1939, approximately 9,000 dwelling units in 29 states and the District of Columbia were completed in apartment house buildings on which the FHA had insured mortgages to the extent of about $33,000,000. Prorating this insured mortgage aggregate to the total appraisal basis, it is apparent that these projects involved aggregate investment in land and buildings of not far below $44,000,000. And this

†Consulting Economist, New York.



is not all, for in addition to the completed projects, now in operation, the FHA has insured mortgages on similar large-scale rental projects now in the course of construction involving more than $51,000,000 of mortgage money and additional equity money of not far below $17,000,000 covering some 13,000 additional apartment house dwelling-units. Topping this, there are, in the nature of a backlog, now pending with the FHA, applications for insured mortgages on large-scale rental apartment house projects, many of which are likely soon to be accepted, aggregating more than $100,000,000 or some $125,000,000 of total appraisal value.

This takes no account of other private apartment house operations which are otherwise financed, actual or pending. Of these the most striking is the Metropolitan Life Insurance Company project in New York City, both because of its immensity, plan, and scope and because of its radical departure on the method of financing. Being erected under the provisions of the O'Brien Act, this project will be wholly owned and managed for rental income by the insurance company, and will house ultimately some 12,000 families involving a capital outlay of about $50,000,000. Description of this project with particular emphasis on heating and ventilating appears on page 44 of this issue. This under-

taking may be considered as but a forerunner of a stream of similar projects by other life insurance companies now that going low interest rates on long-term money are forcing companies to explore the possibilities and unquestioned economic soundness of wholly-owned rental housing projects.

It seems of interest to note in this connection that insurance companies as a group have provided upwards of 50% of all mortgage money for large-scale rental housing projects insured under the FHA plan. Hence the transition, gradual though that may be, from mortgage interest to equity interest in new apartment house undertakings should, for them, represent no insurmountable obstacles. While we are on the subject of the FHA, it is well also to mention that our banks, savings and more lately commercial, are likewise becoming increasingly aware of the possibilities for employing their funds in insured mortgages on rental apartment house types.

Within recent weeks, the Irving Trust Company of New York entered the insured mortgage field with its assumption of a $700,000 FHA mortgage on a large apartment house operation in Stamford, Connecticut. Quickly following this has been the acceptance by this same institution of an FHA mortgage of $875,000 covering a 261 family apartment house development on a seven acre tract in Atlantic City. These, to be sure, are but individual evidences but they may be construed as straws in the wind portending a broadened activity in apartment house construction the nation over, for now there are signs that gentlemen's estates are being redeveloped by builders of investment type housing in increasing numbers. Impetus to this development will likely occur soon since Congress has provided general extension of existing FHA facilities to July 1, 1941, under which terms the mortgage guarantee base will be upped from the present limit of $3,000,000,000 to $4,000,000,000 and this takes no account of those new projects which will eventuate out of the enlarged public housing program already passed by the Senate and virtually certain to pass in the House.

Let us advert once again to the public housing program of the USHA. In about 30 states of the union there are public projects awaiting the *go-signal;* held up chiefly because of difficulties in land acquisition. In the aggregate, when carried to fruition, these will amount to about $700,000,000, with almost one-half of this total actually earmarked as to site and on which work is either actually in progress or is soon to be undertaken. For the most part, these projects will be of the multiple-family variety. Above is an approximate distribution in the states having total commitments of $15,000,000 and over:

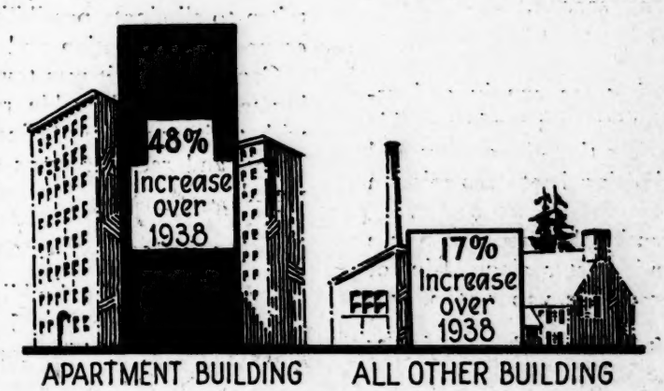
New York	$75,000,000	Louisiana	$25,000,000
Ohio	65,000,000	Maryland	25,000,000
Pennsylvania	60,000,000	Connecticut	20,000,000
Massachusetts	50,000,000	Illinois	20,000,000
Michigan	35,000,000	Kentucky	20,000,000
New Jersey	35,000,000	Tennessee	15,000,000
Texas	35,000,000	California	15,000,000
Georgia	25,000,000	Dist. of Col.	15,000,000

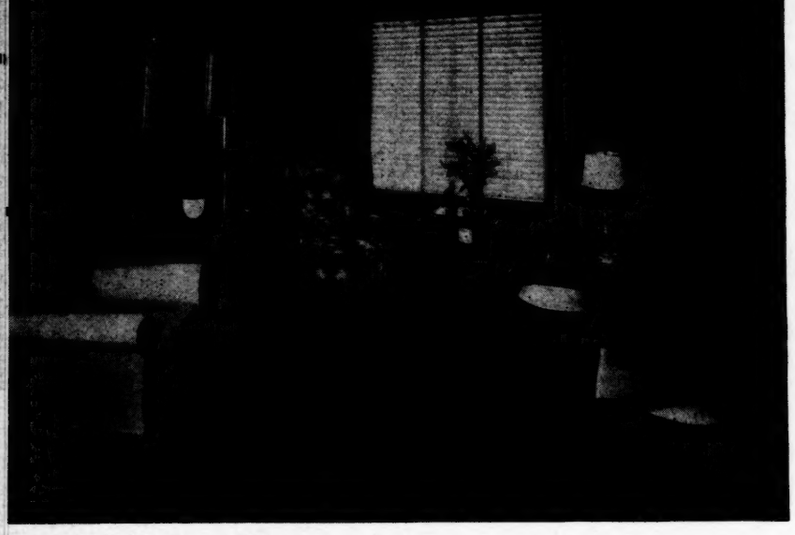
From this array, one who would read while he runs should be able to draw off some conclusions of his own as to the outlook for multiple-family house construction. But lest he still be swayed by the seeming deterioration around him in segments of the economy outside of the building world and even on the international scene it appears timely to indicate that regardless of the causes behind the current betterment in residential construction and especially in apartments, historically there is ample precedent for believing further substantial improvement is in the offing.

We are now at that point in the residential building cycle where investment housing customarily in the past has shown greater proportionate growth than single-family dwellings. And the new elements in the current picture, especially on the side of finance, seem to provide an assurance that the usual pattern will again be followed. And there is a further assurance in the passage of the Desmond-Moffat-Mitchell Housing Act by the New York State Legislature, providing for state credit and cash for public housing for the next fiscal year of $50,000,000 and an additional $100,000,000 in the more remote future—this in addition to funds already earmarked for public housing projects in the state by the USHA.

Almost regardless, then, of what happens in the remainder of the year, it is all but certain that apartment house construction for 1939 will give the best account of itself in any year since 1930. Nor should it occasion surprise if the 1930 figure of about $336,000,000 reported by F. W. Dodge Corporation be scaled, though at the moment this does not appear certain. Nonetheless, in the light of the $205,000,000 total for 1938, results for 1939 will be distinctly gratifying.

One final thought remains. In the four years, 1925-1928, apartment house construction alone in the 37 Eastern states averaged $1,200,000,000 per year. This was the hey-day period of multiple-family construction, as indeed it was of residential building and business generally. But it was made possible largely by issues of guaranteed mortgages and certificates of title and mortgage companies, instrumentalities now justifiably in disrepute. To provide the flow of a like amount of capital funds into apartment house projects, it appears as essential that we quickly accept our new and perhaps sounder mechanisms of finance and make the most of them.





The new style convector placed under a window in living room.

Unusual Downfeed

In last month's issue the central heating plant for the Metropolitan Life Insurance Company's Parkchester Development was described. The accompanying article describes the ingenious design and arrangement of the heating systems in the 51 apartment buildings constituting this great project.

By GEORGE O. DIVINE†

A VAST garden community of apartment buildings is now under way in the East Bronx, New York City. This project, created by the Metropolitan Life Insurance Company, occupies a 129-acre site which was the property of the Siwanoy Indians in 1623 when Jones Bronck, for whom the Bronx was named, landed in New Amsterdam. More recently the property was owned by the Catholic Protectory.

This huge development, which will be known as Parkchester, will consist of fifty-one buildings averaging eight stories in height but with some buildings as many as thirteen stories high. Over 12,000 families, or about 40,000 persons, will be accommodated at moderate rentals in this project, which is believed to be the largest housing development ever erected at one time by private capital.

The apartments will be mostly three and four room suites. A major shopping center, regional shopping facilities, two theaters, and garages for 5,000 automobiles will serve to round out this landscaped project as a self-contained communal unit.

The heating design for this project is the result of an almost ideal cooperation among the owners, the architects and the engineers. The knowledge and experience of the last group was utilized to its fullest extent in holding down initial costs and by assuring low maintenance and operating expenses but at the same time obtaining the best of mechanical service.

Heat Transmission

An unusual arrangement of steam supply and return, through new type convectors, was made possible in this installation due to the fact that the owners and architects cooperated in minimizing heat transmission loss through the walls.

Instead of using the conventional apartment house wall, of water-proof brick and plaster alone, 1-in. of glass wool insulation together with a vapor stop, was provided between the brick and plaster. This added to the installation cost of the building but, on the other hand, resulted in a sharp saving in heating system capacity, as well as a considerably lower operating cost. The relatively low interior wall temperatures usually found are eliminated, and the necessity of carrying high air temperatures within the room to avoid discomfort from absorption of radiant body heat by the interior walls has been greatly reduced.

It is believed that the resulting conditions will be such that the fuel savings will be greater than shown by a straight mathematical calculation of heat loss, due to this reduction in body radiant heat loss.

Heating Medium

Sub-atmospheric steam was selected as the heating medium, as it was felt there were inherent advantages in low steam temperatures at sub-atmospheric pressures, as well as more flexible control in varying the steam temperatures to suit changes in outside temperatures.

Since the range of operating pressures was determined to vary, dependent upon outside conditions, from a vacuum of 25 in. of mercury (steam temperature 133F) to a gage pressure of 2 lb. (steam temperature 218F), it became obvious that a permanently tight system must be provided and that any steps taken to eliminate possibilities of leakage would assure economy of operation and maintenance.

Consequently, it was toward the problem of dispensing with the vulnerable radiator branch connections, with their numerous fittings and joints, valve stuffing boxes, and radiator traps that much thought was directed.

Heating System

Steam enters the building from the high pressure mains and is reduced to 5 lb. at the pressure reducing valve (1) Fig. 1. The control valve (2) is a motor-

†Assistant Engineer, Baker, Smith & Co., New York, N. Y., heating contractors for the project.

Steam Piping in 51-Building Project

operated, graduated-action valve, the percentage of opening of which is regulated by the various thermostatic control appliances according to the heat demand. There is one of these valves in each building.

At some convenient point in each building a heat balancer radiator (3) is located. This heat balancer operates to insure proper circulation in response to the requirements of the selector thermostat (5) in accordance with the demand for heat. There is one selector in each building located at a window where it is responsive to both the weather and the building temperature. Additional means are provided at the panel (6) for manual adjustment of the heat being supplied to each building.

The vacuum pump controller (7) which is connected to a supply and return riser and thus is actuated by the pressure differential between these lines, governs the vacuum pump (8) operation so as to maintain the pressure differential needed for circulation.

Riser Arrangement

The simplicity of the installation is readily discerned when it is noted that the conventional bathroom and kitchen heating risers are employed as a means to deliver the steam to its points of utility. These risers are carried from the steam mains in the basement to the top floor ceiling where they transfer to the adjacent room radiator locations (or to two in the case of four and five room apartments) then descend through a series of cast iron convectors, each of which constitutes an offset on its particular floor for its descending riser. (See Fig. 4.) Each riser alternates its position from one side of the window to the other as it goes down through successive floors until it finally is tied to the basement return main by means of a float and thermostatic trap.

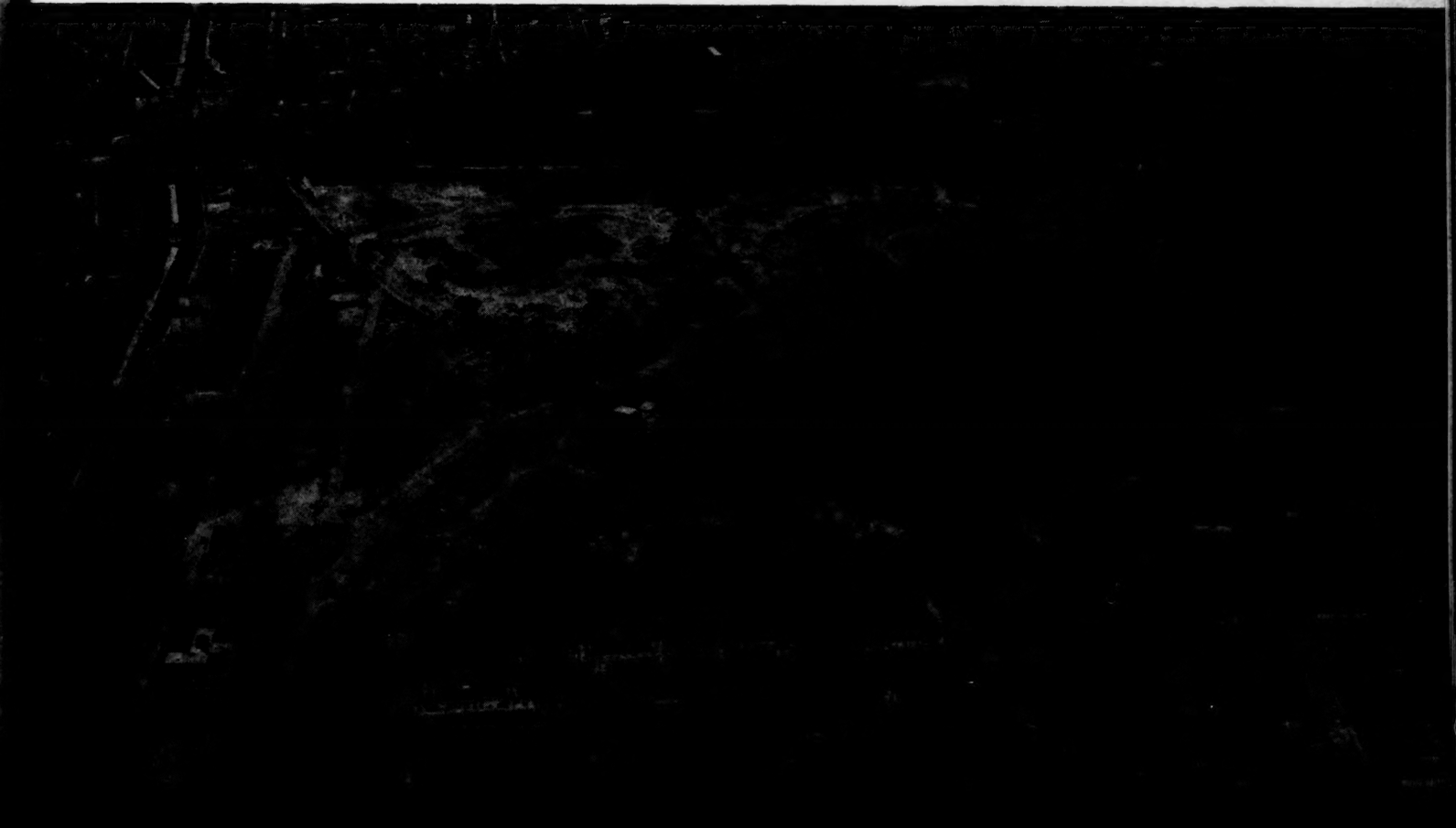
The weight of the piping and convector is supported on each floor by a bracket integral with the convector enclosure at the outlet end. The alternate top and bottom connections of the risers to the convectors provide the flexibility necessary to take expansion strains.

Convectors

The convector itself is of entirely new design, consisting of two hollow cast-iron chambers with vertically-finned outside surface. The casing is in two pieces: the back, which is bolted to the wall and at the pipe outlet end has a bracket to support the convector element, and the cover which includes the top, front, and ends. The inlet end of the convector element is supported by the riser, so that the weight of the inlet end is being carried by the bracket on the casing of the convector on the floor above.

Appearance of the room installation may be appreciated when it is realized that the convector enclosures are but four inches wide and extend just far enough beyond the line of the window jamb to enable the risers to clear the windows. The connections of the riser and convector are accomplished merely by a nipple in the convector tapping plus a union to the riser.

Convector enclosures are fitted with dampers which allow the room occupant to control the heat output, within the maximum limit of the thermostatic control



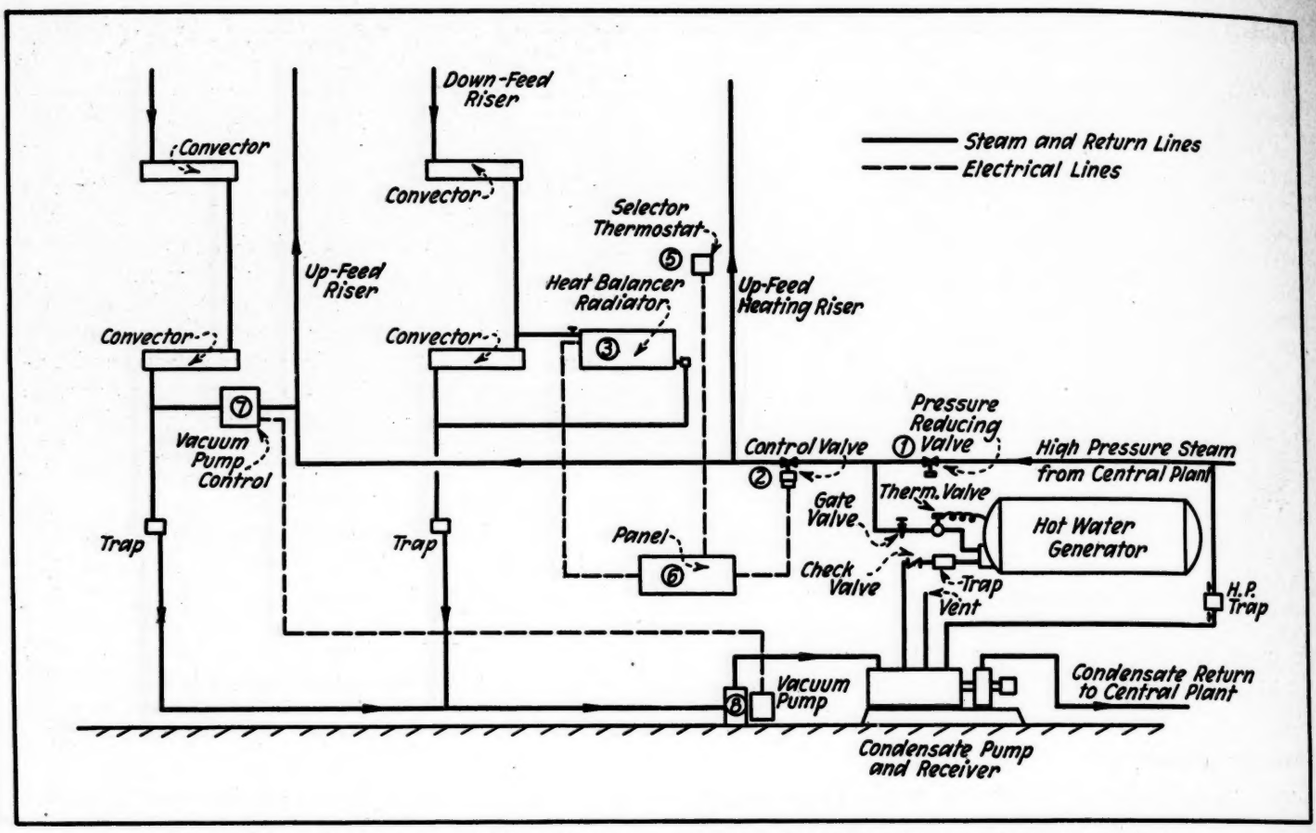


Fig. 1. Schematic diagram of differential vacuum heating in Metropolitan's Parkchester project.

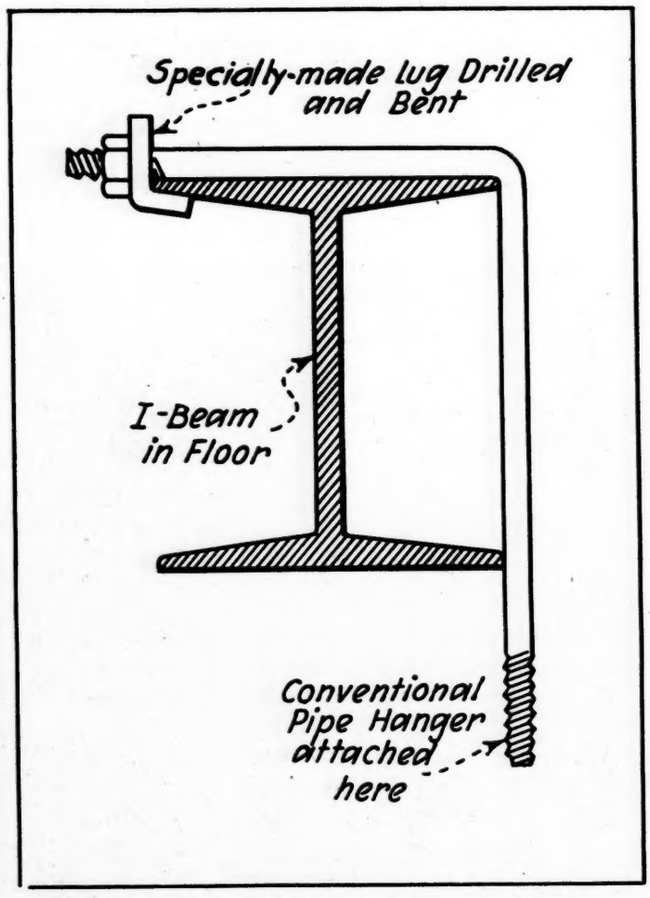


Fig. 2. How mains are supported in the basement. The lug and rod are placed before concrete is poured.

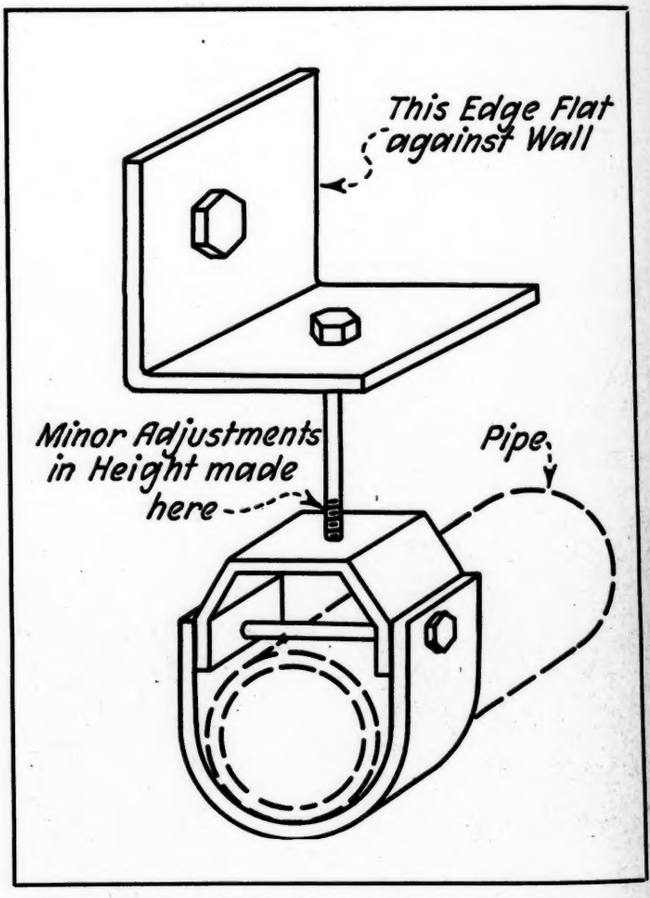


Fig. 3. Return piping along the basement wall is supported in this manner.

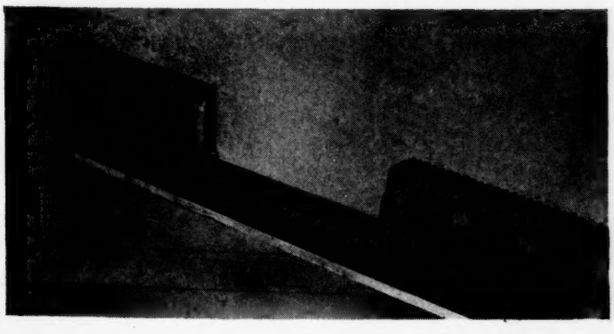
system, by regulating the circulation of air through the convector. The thermostatic control system is, of course, the mechanical economic governor which prevents overheating and its attendant waste of fuel.

Probably the most striking point about the installation is its simplicity. Due to the size of the project, it was desirable that this should be so and that every possible arrangement be made to facilitate erection and reduce installation costs. This was particularly true in the case of the piping. Inasmuch as all ceiling heights throughout the project are the same it was possible to cut and thread all of the pipe going into the risers at a central pipe cutting and threading shed. Pipe is delivered to this shed from the freight cars, cut and threaded to standard lengths and from there taken to the building where it is to be used.

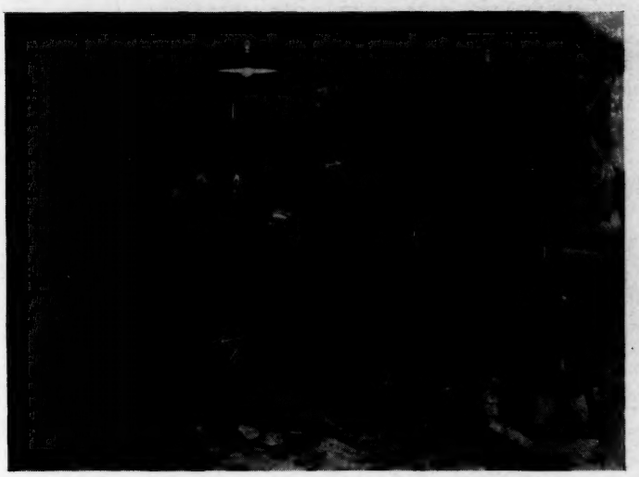
All of the up-feed risers are either 2 or 2½ in. in diameter while the down-feed risers are 1½ in. In the case of the up-feed risers these lengths were so laid out that the joint would occur at the floor. The lengths are joined by simple couplings, but at the joints in the riser, where it is to be anchored, there are pipe clamps, immediately below the coupling, which rest on adjacent I-beams in the floor. Consequently, the riser is supported through the coupling, sleeve, and pipe clamp by the I-beams. This arrangement is shown in Fig. 6. The pipe clamps were made up in large quantities for the two different size up-feed risers at the central field shop.

On the down-feed risers the lengths were cut so that there would be no joint between each of the succeeding convectors except the necessary union. In other words, when leaving a convector, there is found, when moving in an upward direction a short nipple, a brass-to-iron ground joint union and then a standard length riser which is screwed into the convector above. Any major adjustment in height of convector desired is taken care of by varying the length of the nipple. Minor adjustments in heights can be made on the convector bracket.

In a number of cases, steam is not introduced from the high pressure steam lines directly into the building to be heated, but steam is provided to these buildings from an adjacent building in which the pressure reducing valve station is located. The low pressure steam is taken directly from a header from the first building and supplied to the second building where an additional set of differential controls is located. The condensate is pumped from the second building to the first building where it joins the condensate from the first building, and is pumped back to the central heating plant.



New design cast iron convector with vertically-finned outside surface. Convector length is varied by varying lengths of pipe nipple between two sections.



Pipe is delivered from freight cars to a shed on the site, where it is cut and threaded to standard lengths and then taken to the building where it is to be used.

Steam mains in the basement are supported by bent rods hung from the floor I-beams, as shown in Fig. 2. Each end of the rod is threaded and a lug, held by a nut, keeps the hanger in place. All of this, except the threaded free end, is later covered by concrete. The rod has sufficient thread to allow adjustment of the pipe hanger for pipe slope.

In the case of the return piping this is supported also by fittings largely made on the job. Angle-iron is cut up into short pieces, one side of which is bolted to the basement wall by expansion bolts, while the other is drilled to allow a bolt to pass through as shown in Fig. 3; on this the usual pipe hanger is attached. Minor adjustments in the slope can be made in the pipe at the pipe hanger end. Major adjustments are made by varying the height at which the angle iron is bolted to the wall.

Not all of the piping in the basement is insulated; heat loss from the bare pipe is sufficient to maintain desirable temperatures in the basement utility spaces.

An important simplification of the piping installation in this project lies in the use of the seamless steel tubing for pipe sleeves to provide the necessary openings through the floors. Tubing for sleeves has advantages over pipe, both in weight and cost, and, in addition, since it is lighter, can be handled with less effort. A sketch of the tubing sleeves is shown in Fig. 5, which gives the dimensions and shows the boss which projects about ½ in. and is approximately 1 in. in diameter. This projection anchors the sleeves to the concrete floor slab.

Hot water in each of the apartments is supplied from large generators which are hooked up as shown in Fig. 1. Steam is admitted through a thermostatic valve at 5-lb. pressure from the steam headers. The generators range in capacity from 1500 gal. per hr. to 4500 gal. per hr. The hot water is delivered at a maximum of 180F.

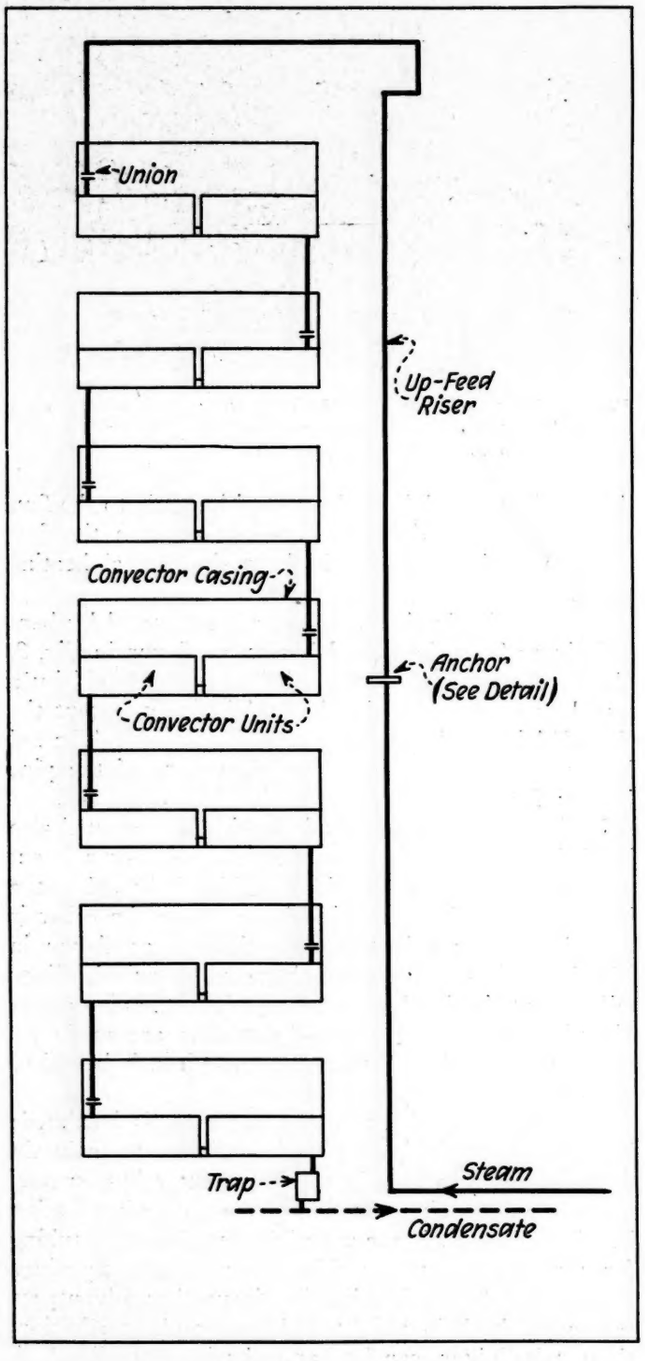


Fig. 4. Schematic diagram, not to scale, showing riser layout. There are no radiator valves or traps; the only trap used is where the downfeed riser drains to the return main. Heat output of the convector can be controlled manually as desired by a damper in the convector air stream. Patents have been applied for on the system.

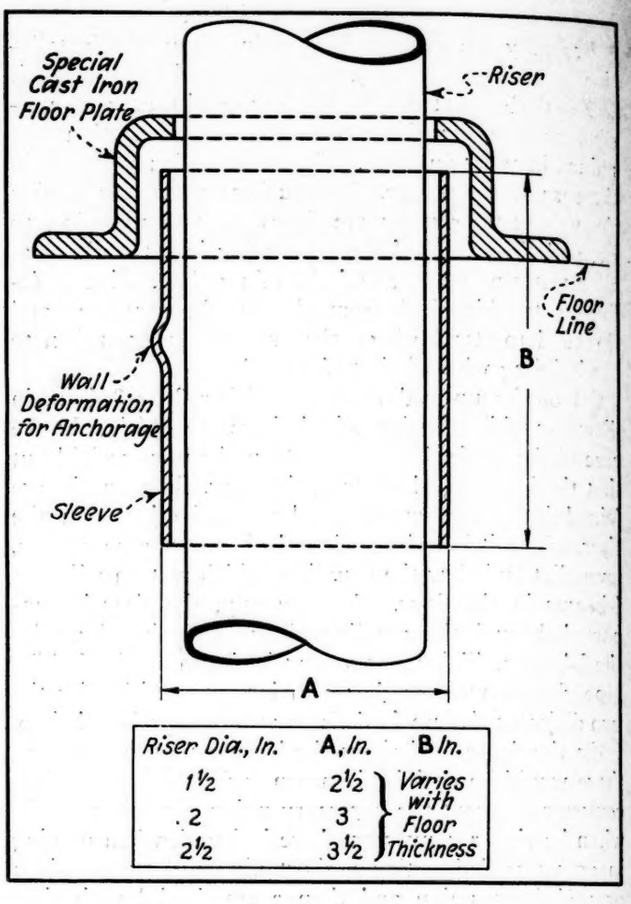
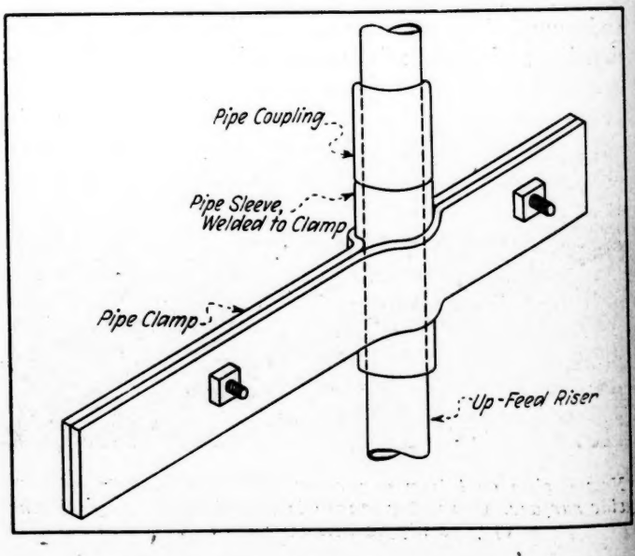
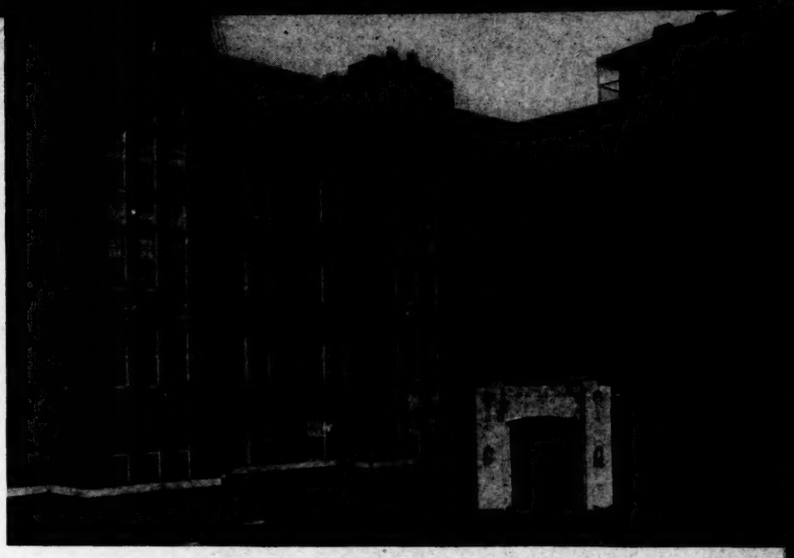


Fig. 5 (above). Sketch and dimensions of steel tubing used for floor openings for the downfeed risers. The extruded wall section boss anchors the tubing. The floor plate allows for slight variations in length, as shown.

Fig. 6 (below). Method of anchoring upfeed risers. The weight of the riser is carried by the pipe sleeve on which coupling rests. The clamp is welded to the sleeve and supported by adjacent framing steel.



Stoker Helps Building Satisfy Smoke Code



Garden Towers Apartments, Washington, D. C.

A GOOD example of how fuel combusion practice is affected by the enforcement of smoke prevention laws is furnished by the heating plant of the Garden Towers apartment house, 2325—15th St., N.W., Washington, D. C.

This apartment which is one of Washington's most modern, is a six-story building with a total of 77 apartments. The apartments are principally of the one- and two-room type and are designed to care for the needs of single persons and couples in the employ of the government. The building is heated by a two-zone, differential system with approximately 6900 sq. ft. of steam radiator surface, principally in the form of wall convectors. Steam is supplied to both the heating and service hot water system by a steel, fire-tube boiler.

The smoke law of the District of Columbia as revised in 1935 states that no person shall cause, suffer or allow dense smoke to be discharged from any building . . . place or premises within the District of Columbia . . . nor shall any person cause, suffer or allow cinders, gas, steam or offensive or noisome odors to escape or to be discharged from any such building or place.

As a result of this act the Division of Smoke Regulation and Boiler Inspection has drawn up a number of rules and regulations governing the installation of fuel burning equipment. Among other things these rules state that all heating boilers having an equivalent direct radiation rating of more than 1200 sq. ft. of steam radiation or 1800 sq. ft. of water radiation shall be equipped with an underfeed stoker, apparatus to burn pulverized coal, oil burner or gas burner unless the owner of the building or plant enters into a fuel agreement. Such an agreement provides that either anthracite or coke be burned. If the boiler is over 5000 sq. ft. radiation rating or the equivalent a mechanical fuel burning device must be used.

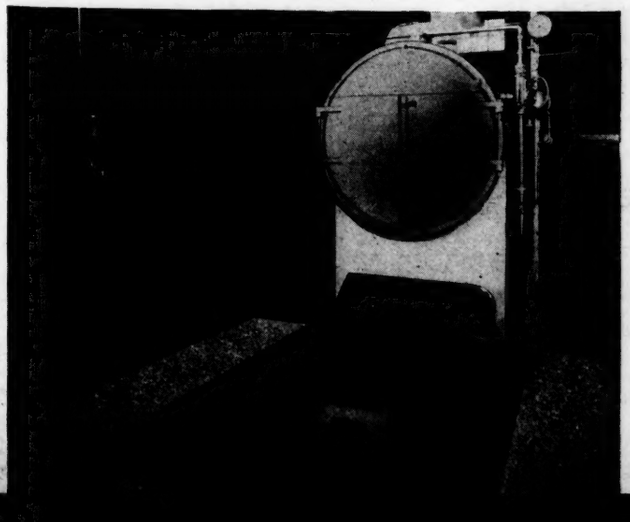
Boilers under 1200 sq. ft. radiation must burn coke or anthracite or be equipped with an underfeed stoker, oil or gas burner.

Since this building has over 6900 sq. ft. of steam radiator surface it was necessary to provide a mechanical firing device for the fuel. An underfeed stoker burning 1¼ in. nut and slack coal was selected primarily because of the owner's experiences with this method of firing in other apartments owned by him.

The stoker is of the ram feed type and is mechanically driven with a variable speed motor so that it may be driven at a speed in accordance with the steam demand. The stoker hopper is equipped with an agitator to insure constant feed of the coal to the retort. After the coal is burned the ash is moved to two dumping grates, one on each side of the retort. The dumping grates are operated from the front of the boiler and the ash is periodically dropped to pits from which it can be removed through ashpit doors at the front of stoker without disturbing the operation of the stoker.

A constant steam pressure is maintained on the boiler by a pressure control which starts and stops the stoker motor. The speed at which the ram feed is driven is controlled by a variable speed regulator which is set by the operator in accordance with outside conditions.

In the breeching just before the stack is a cinder trap which is required by the smoke control law. This trap is made of the same material as the breeching and catches the cinders and fly ash in a hopper which has a cleanout door so that the cinders can be removed from time to time.



A corner of the boiler room. The single boiler shown supplies steam for both heating and service hot water. Stoker is of the underfeed ram type.

Tenants Control Air

A high class Washington apartment with year-round conditioning; centrally heated and chilled water, pumped to individual room conditioners. Tenants control individual room conditions with central control of plant operation. Stoker firing, evaporative condensers

Fig. 1. Townhouse apartment in Washington.

TOWNHOUSE, located at 601 19th St., N.W., Washington, D. C., stands as an example of an attractively done, high-class, modern apartment. It is equipped with a summer-winter air conditioning system with individual room control. Its eight stories provide a total of 96 apartments, while the basement is occupied by a drug store, a tailor, beauty, and barber shop. The exterior presents an attractive appearance with its modern architecture, and Townhouse is reported to have been fully occupied virtually as soon as it was opened in September, 1938. Included in its 85-ft. height is a volume of over 600,000 cu. ft.

Careful Planning Necessary

Providing an air conditioning system suitable for a modern apartment of this character requires a careful balancing and studying of tenant requirements and of tenant likes and dislikes. Since the type of occupancy in an apartment of this kind cannot always be anticipated it follows that considerable flexibility should be built-in in order to provide capability of meeting the varied demands of an individualized group of tenants. In Washington, especially, where so many of the office buildings have been cooled, it is likely that an apartment of this character will include tenants whose daily work keeps them in an air conditioned atmosphere and who will want to maintain the same conditions in their living quarters. On the other hand some tenants are bound to be subjected to the prevailing outside weather conditions and will want only a modified amount of summer cooling. So far as winter heating is concerned there is the same variation in individual tastes. Elderly members of the family will scarcely ever want very much cooling but they will want a high temperature in

Conditions All-Year in Washington House

their rooms in winter. Small children and babies must have constant temperature quarters. With all these individual variations in tastes and demands to take into account the air conditioning system installed in Townhouse, while something of an innovation, is thought to be especially suitable for buildings of this character.

Room Conditioners

The system makes use of individual air conditioning units in each room. Each unit is connected to outside air supply and is under the full operating control of the room's occupants.

The conditioning unit is about the size of an ordinary cast iron radiator, is surrounded by a metal cabinet neatly finished with baked enamel and trimmed with chromium bands. Modernistic lines are secured on the cabinet by rounding off tops and ends to give the effect of a console table. No piping, wiring or controls are visible but are entirely enclosed by the cabinet. Some details and an idea of the appearance and location of these room conditioners are given in Fig. 2.

While the conditioning is accomplished in each individual room this is only possible because heat and cold are supplied to the conditioning unit by circulating water to and from it. In winter, hot water is supplied, while in summer chilled water is circulated. A schematic diagram of the arrangement of piping necessary in order to accomplish this desired circulation of water is indicated in Fig. 3.

Piping System

It will be noted that the piping system is an overhead downfeed. The supply mains are located in the space between the eighth floor ceiling and the roof. Downfeed risers from these mains supply hot or chilled water to the individual conditioning units in each room. Return risers parallel the feed risers and are collected into a trunk return main which is connected to the centrifugal circulating pumps. The pumps circulate the return water in winter through a six-pass converter which raises it to a predetermined temperature and then pass it up the main riser to the top of the building to begin the cycle over again. Heat is supplied to the converter by steam through a low-pressure water tube steel boiler. The boiler is automatically fired with a stoker using nut and slack coal.

The summer cycle of circulation is the same as during the winter except that the return water from the system is bypassed around the converter to an 80-ton F12 water cooler where it is cooled to 40F and then passed back through the system again. The water is cooled in a shell and tube water cooler by means of two 40-ton compressors using F12 as the refrigerant.

Fig. 3 also indicates that kitchens and bath-rooms are supplied through a separate system of piping. It may be noted that the piping is so arranged that during winter operation water is supplied to these rooms the same as to other rooms in the building. During summer, however, by adjusting the valves in the basement, chilled water will not be circulated through the direct radiators which heat these rooms. Since these radiators are exposed and no provision is made for collecting condensation from them, passing of the cold water through them would cause sweating which would lead to operating difficulties. All outside kitchens are equipped with individual exhaust fans while all inside kitchens have mechanical exhaust ventilation which is required by law in Washington. Corridors are also given six air changes per hour with an exhaust ventilating system which is also required by law and a pull is thus exerted on the corridors thereby causing leakage from the apartment entrance doors toward the corridors. Odors have thus been effectively eliminated.

Description of Room Units

Since the individual room units are so important in the plan of air conditioning used in Townhouse a further detailed description of what these units contain is given here:

1. A three-pass galvanized copper element with bronze headers at either end through which hot water or steam is circulated for heating and 40F chilled water for cooling in summer.

2. Directly alongside of the element is a copper water pan, louvered, to permit warm air to be passed over the water to pick up moisture for humidifying in winter. This copper pan is automatically kept full of water controlled by a float-actuated valve connected to a ⅛-in. cold water pipe. A ¼-in. overflow connection is provided at the opposite end of the water pan. Water pan and float valve mechanism are readily accessible as the entire top of the unit is removable. To facilitate sufficient water evaporation for humidification several copper coils are located near the bottom of the water pan through which a little steam or (hot water) is constantly circulating. Both cold and hot water can readily be shut off by small valves if desired.

3. A standard radiator valve is located at the inlet end of the heating and cooling coil in order that the occupant can obtain air circulation without cooling or heating the air. This is desirable if the occupant desires to introduce a large quantity of fresh air at night. Valve is located at top of unit just under access door in top of cabinet.

4. Condensation from the coils during summer cooling is collected in a full size pan located just under the coils and is carried off by a ½-in. copper drain pipe to the vertical drain risers. All vertical drain risers are

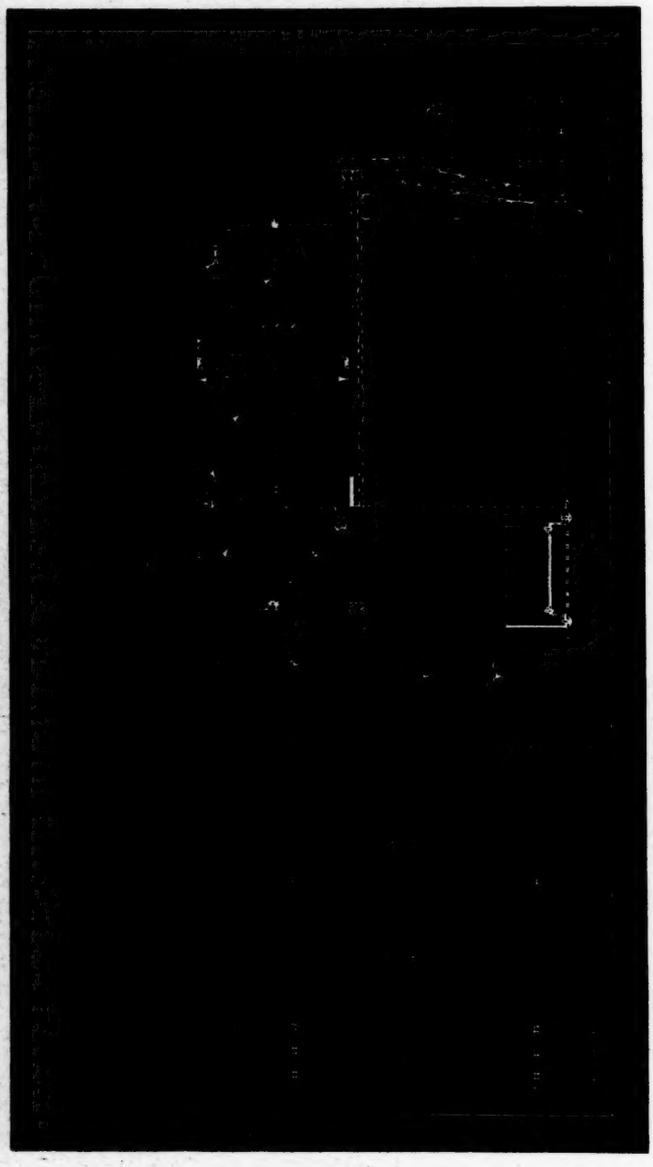


Fig. 2. Diagram of arrangement and principal dimensions of individual room conditioning units.

copper and are collected into a main trunk line at basement ceiling. This water is not wasted but is conducted to the water trough of the evaporative condensers to serve as partial water makeup.

5. Air is supplied each unit by two multiblade aluminum fans mounted on a single shaft and propelled by a 1/20-hp. capacitor type electric motor. Fan and motor assembly are slung on live rubber gummets to reduce vibration to a minimum. Motors are three speed with selector switch located inside top of unit convenient for occupant. (It was found that the lowest speed is sufficient for all heating conditions.) Mechanical parts are noiseless—the only sound made is the air rushing through the staggered coil fins and is not objectionable.

6. Temperature control is effected by means of special summer-winter thermostats located just inside the inlet grille and in the air stream. Compensation adjustments are readily made to maintain the desired room temperature the year round.

7. All air introduced into the unit must first pass through an air filter. Filters may be of the cleanable or renewable type. Insides of cabinets are insulated.

8. Just below the air filter is a proportioning type damper permitting up to 25% fresh air directly from outside and 75% recirculated room air to be drawn through the unit; heated, humidified, filtered in winter or freshened, filtered, cooled and dehumidified in summer. Damper is accessible to occupant who can regulate fresh and recirculated air at will.

9. Outdoor air is introduced by means of a wall box fitted with fine screen, louvers, and an outside grille located on face of building. The design of the outside grille can be varied to conform with the architectural treatment of the building. How inconspicuous these grilles may be made can be seen from Fig. 1 where they are located under the windows but where they add to the attractiveness of the masonry panels in which they are located.

For summer operation each air conditioning unit requires approximately 3 g.p.m. of 40F water in order to get 25% latent cooling. All units have a heat gain of 9,000 B.t.u. per hr. when supplied with 40F water.

The heat gain of the building was carefully computed and the base condition figured for 95F outside dry bulb and 78F wet bulb. Each unit will afford 50% relative humidity and 80F dry bulb in the room when working against an outside dry bulb of 95F and a 78F wet bulb. The load estimate included suitable amounts for lights, people, sun, filtration air, and 25% fresh air.

Pipe Insulation

Where the same piping must carry both hot and cold water the question of a suitable pipe insulation is very important. Not only must heat loss be prevented when hot water is being carried but heat gain in summer

must also be minimized. After considerable study double thickness inch and a half covering was selected to cover all pipes carrying chilled water. All pipes around air conditioning units were also covered with this same covering and hair felt was packed around crevices where there is likely to be circulation of air. The shell and tube water cooler was insulated with rock cork as were all refrigerant lines from the compressors. Operating experience has indicated that with the pipe insulation used there is seldom more than a 7F drop in water temperature through the heating season.

Central Gage Board

As is indicated in Fig. 3, water temperature in the heating system is automatically controlled by a temperature regulator placed in the steam line leading to the hot water converter with the regulator bulb located in the hot water mains at the point where they leave the converter. Incidentally, the temperature of the service hot water is controlled in a similar manner except that the regulator bulb is located in the water storage tank. During operation the temperature regulator is adjusted to vary the water temperature in the heating system with changes in the outside temperature. The system was designed for a maximum water temperature of 200F. In order to take care of the expansion of water with changes in temperature a water expansion tank is located in the penthouse above the highest point in the system and has an overflow line to the basement drain. A constant water level is maintained in this tank by means of a float which actuates a solenoid valve on the water feed line in the boiler room. Air is released from the system by means of traps suitably located in the piping system and with the vents piped to drains.

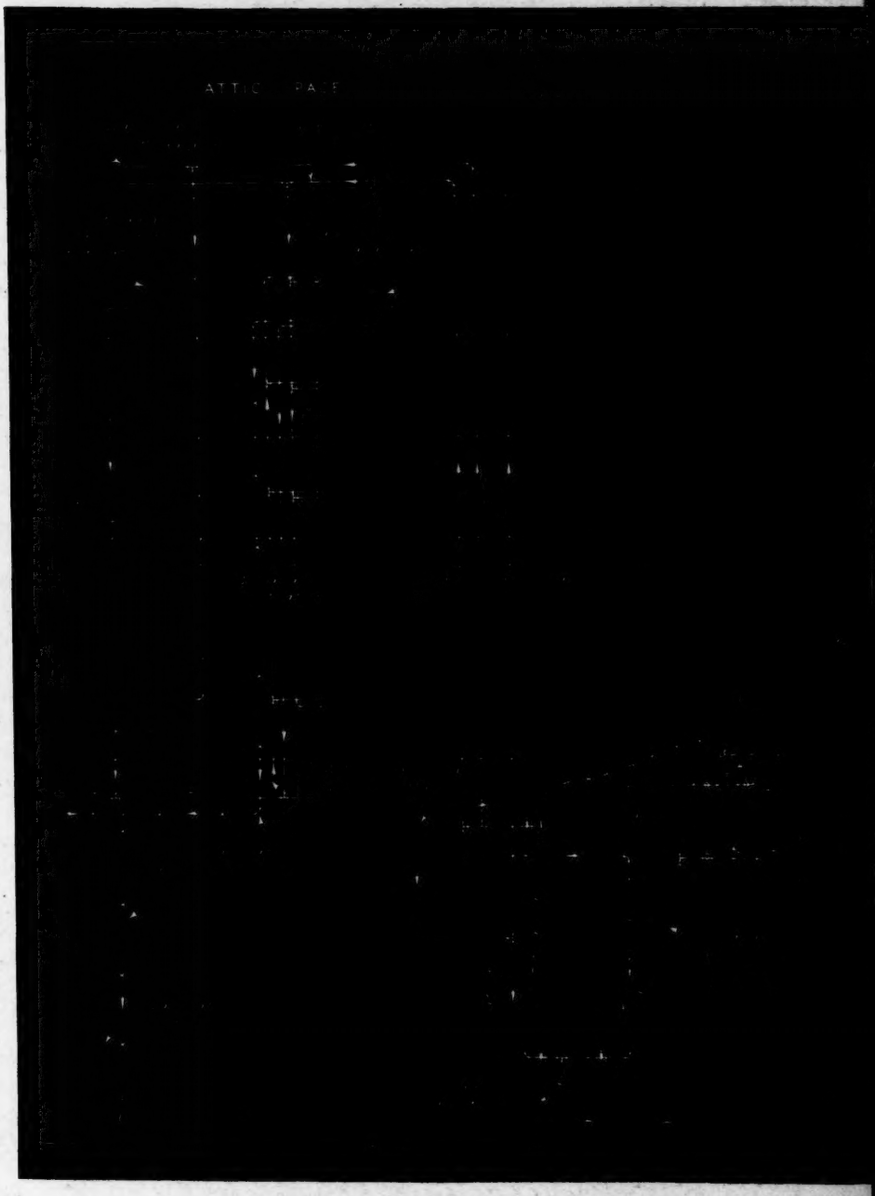
In order that the operator may have suitable indication of the water temperature, two 8-in. dial thermometers are connected to the supply and return mains and located on a steel panel board in the basement along with a combined pressure and altitude gage, draft gages, boiler pressure gage, and stoker pressure control. This has the effect of concentrating all the operating instruments at one point.

Two evaporative condensers are installed outside and adjacent to the building.

One of the interesting features in connection with the provision of this type of plant is that the absence of any duct work on the basement ceiling was one of the factors which made it possible to secure additional revenue by making this basement space into a drug-store and personal service shops.

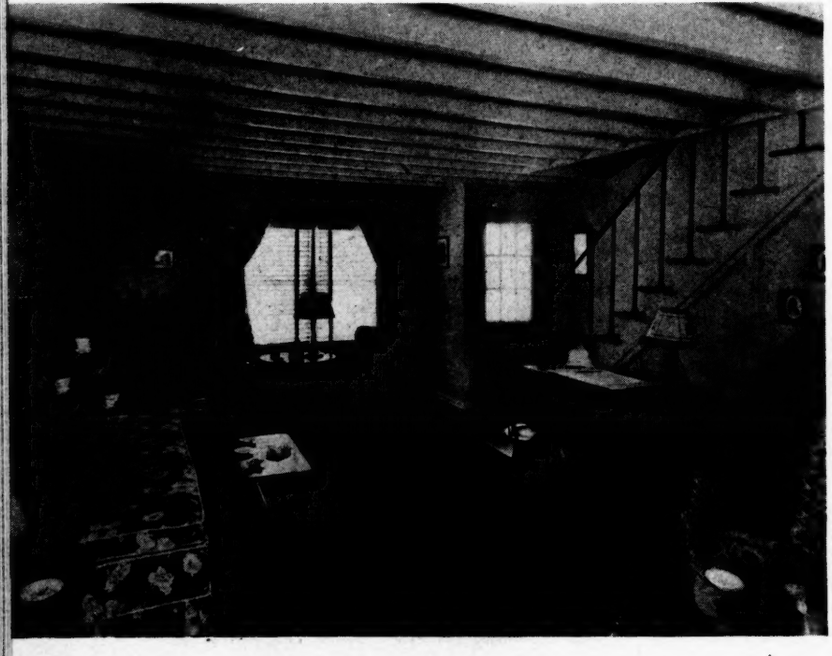
Builders and owners are L. E. Brenninger & Sons; architect, Harvey Baxter; engineer, George F. Miller; heating and air conditioning contractor, Eberley and Brand, Inc.

Fig. 3. Diagram showing arrangement of piping for both winter and summer operation.



Horizontal Type Suburban Apartments

Particularly in suburban districts there is a marked trend toward horizontal type garden apartments. Described here is a typical one of these developments. In this particular case due to the grade it was found inadvisable to have a central heating plant so that each one of the buildings has its own heating plant which consists of a stoker fired hot water system burning anthracite.



FOR a good many years the majority of new apartment buildings has been of the vertical type—that is, vertical rows of apartments one above the other and each apartment of the row identical with the apartment above and below it. Duplex apartments have, in general, been confined to high-priced developments, such as those on Park Avenue in New York.

At the present time there is a marked trend toward horizontal apartments. This idea, when carried to its limit, is a duplex arrangement whereby the equivalent of small single-family houses are joined together horizontally under one roof; when these apartments are identical they become row houses. A variation of this idea, however, is to vary the exterior architecture and interior arrangement of the duplexes so that the monotony of the row house type development is avoided, and when this is done the project can be extremely attractive as the development here described indicates.

This project, the Beech Spring Garden Apartments, is located on the edge of the suburban town of Summit, New Jersey, 25 miles from New York. The development consists of six buildings with 43 apartments, totalling over 161 rooms. The project covers 3½ acres and the apartments, which range from three to five rooms, rent for $50 to $70 a month.

The project was built in 1938 and opened in the fall of that year. At the present time all apartments but one are rented. Included in the project are two garage buildings which serve the whole project. The accompanying plot plan shows the general arrangement. With the narrow type of building used, each apartment has a front and back door and a front and rear yard.

Figs. 1, 2, and 3 (top of page). Some of the buildings in the Beech Spring Garden apartments, Summit, N. J. Fig. 4 (left). Interior of a typical apartment.

Heated by Stoker-Fired Hot Water Plant

The exterior walls are of 8-in. cinder blocks, with some finished in brick, others in stucco, and with reinforced cinder concrete lintels, ¾-in. furring, metal lath and plaster. The interior partitions are 2-in. solid plaster with the dividing partitions between apartments of 8-in. cinder block. There is a ¾-in. air space in the exterior walls.

In selecting the heating for the project, this narrow air space became a determining factor. The various buildings have as much as 25 ft. difference in grade and for this reason it was decided that a central heating plant for the entire project would present some problems. Consequently, each building is heated by its own plant and, in view of the narrow air space in the exterior walls, forced hot water heating using copper tubing was employed in order that the piping could be run through the narrow space available in the walls.

Each building is heated by a jacketed cast iron sectional boiler which is fed by a bin-type stoker. Coal is stored in the bin with sloping sides, the bottom of which connects with the stoker worm so that there is no filling of the hopper necessary. A concrete pit with steps beneath the boiler is provided for an ashcan which the janitor removes at intervals.

The heating plant is controlled by a thermostat located in one of the living rooms. This thermostat is concealed and the occupants of the apartments do not even know that the controlling device in their building is in their apartment so that they do not tamper with it. This works in conjunction with a limit switch to control the operation of the stoker.

Domestic hot water is supplied from two horizontal type indirect heaters located above the boiler. The

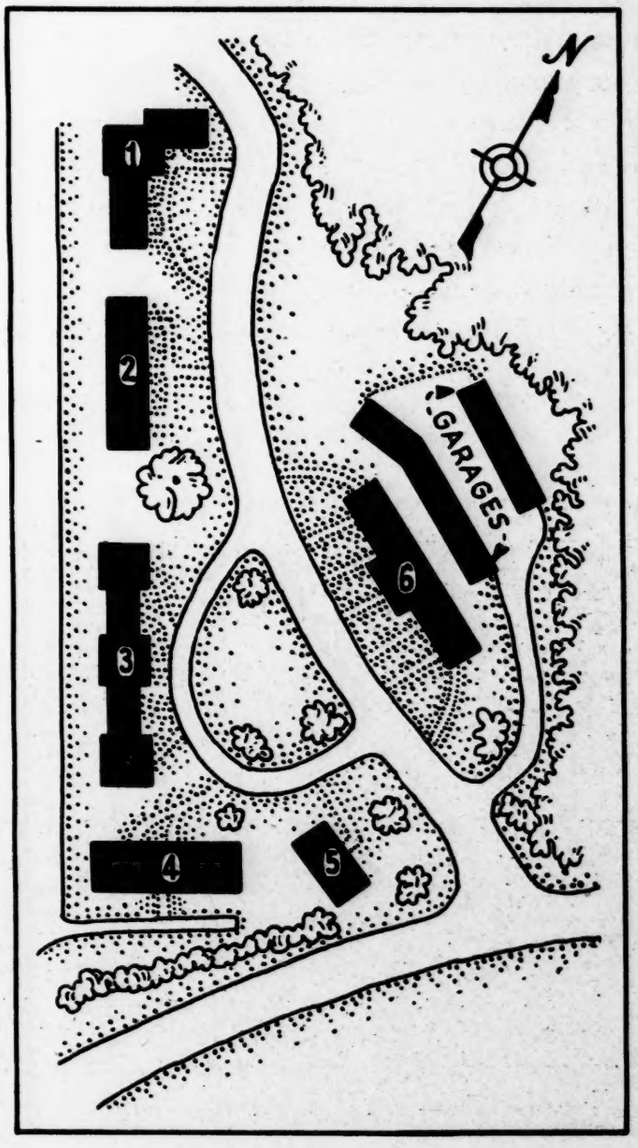


Fig. 5 (right). Plot plan of the Beech Spring Garden development at Summit.

STOKER FIRED WATER PLANT

heating system itself is a one-pipe job with soldered copper fittings.

There is a total of 8,033 sq. ft. of hot water radiator surface in the project, all of it being of the cast iron direct slender type.

The radiator schedule is as follows:

Building No.	No. of Apartments	Sq. Ft. Rad.
1	7	1404
2	6	1226
3	10	1938
4	6	1535
5	4	699
6	6	1231

The builder, New Providence Development Corporation, W. E. Closs, president, is planning another project on adjacent land, to be built during the summer of 1939. The architects of the project were E. R. Closs, of Sparta, N. J., and D. C. Washington, associate, of New Providence, N. J. The heating contractor was David Graham.

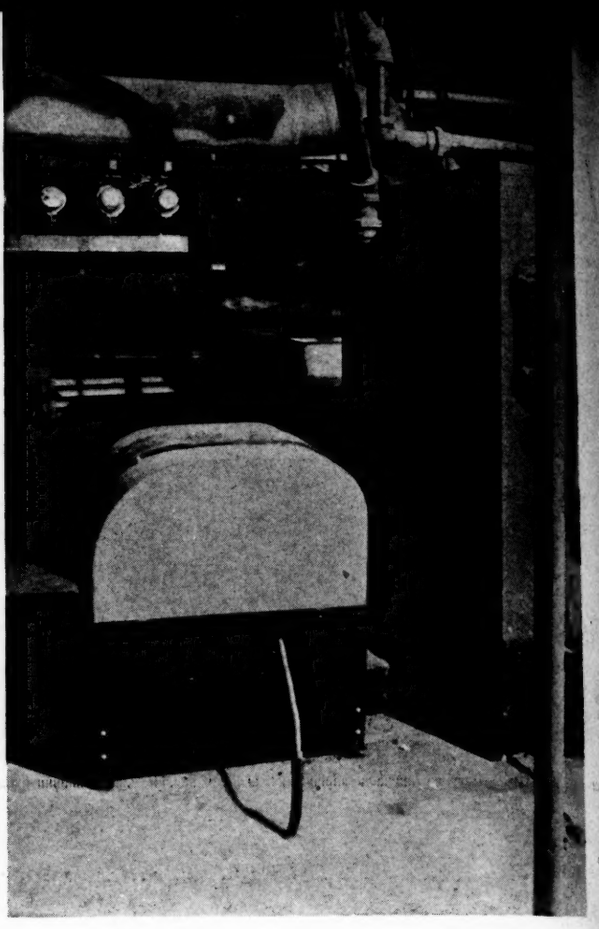


Fig. 6. (upper right). Stoker as used in each building in the Summit development.

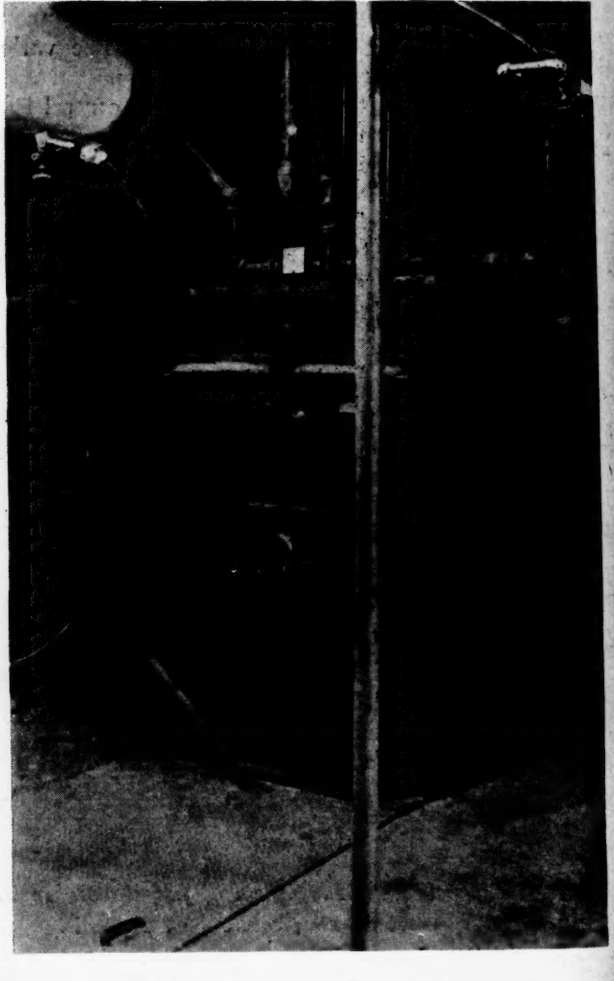
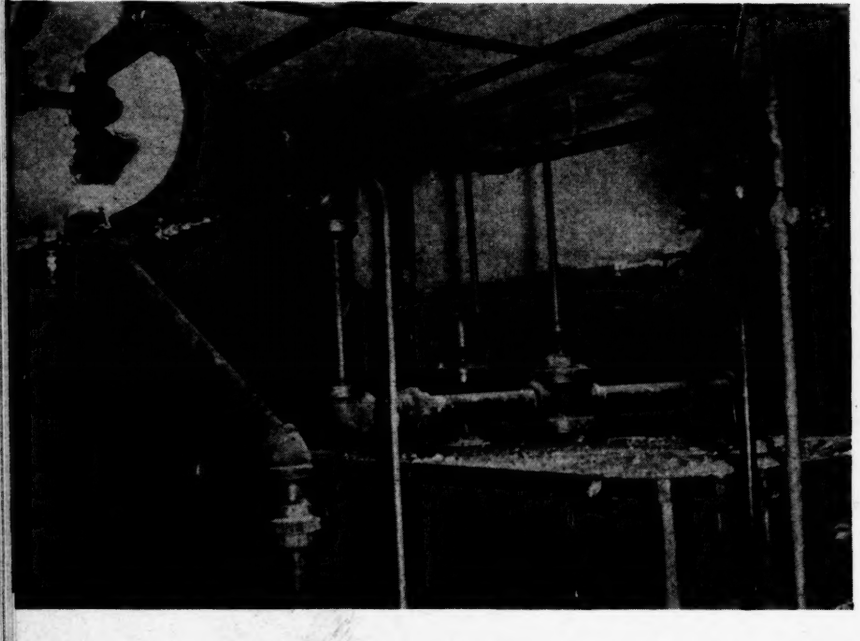


Fig. 7 (below). Boiler piping, showing hot water storage tank's connections.

Fig. 8 (right). Cast iron sectional boiler as used in each building at Beech Spring Garden, Summit, N. J.



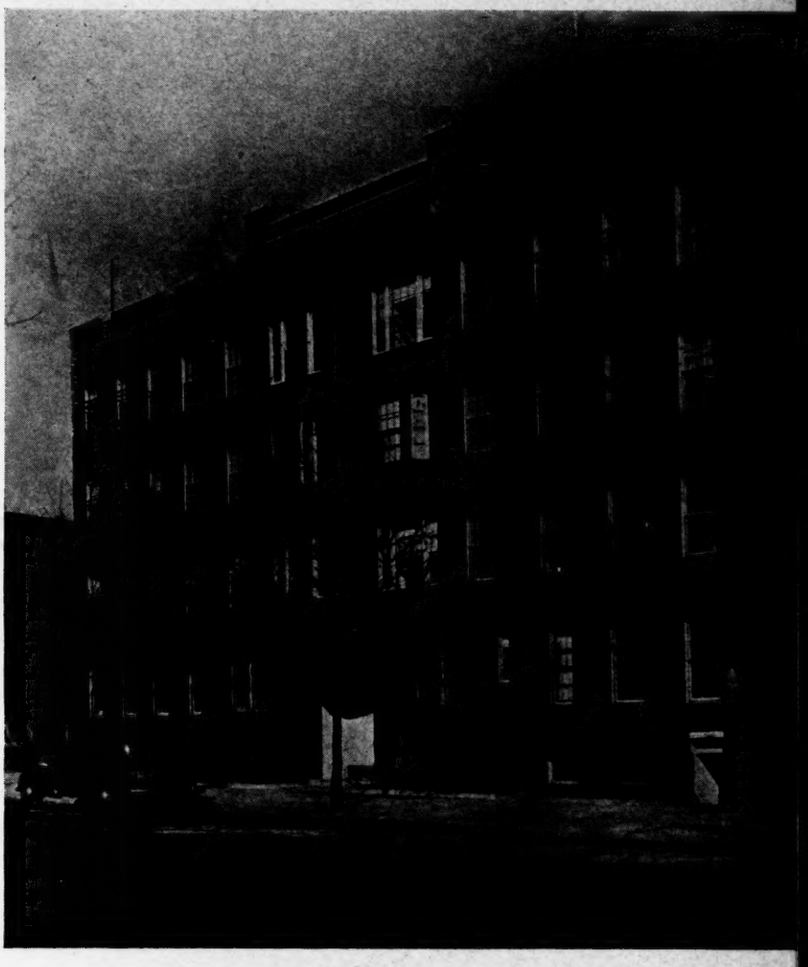
Low Cost Heating for Modern Apartment

This installation is a good example of a system designed to meet the owner's demands for a heating system with a low initial and operating cost and at the same time satisfactory heating.

THE apartment house builder who is building for investment and not speculation is interested in securing a building which will have a low-operating cost and at the same time an initial cost that is within reason. Since one of the largest items in the operating cost is the cost of fuel, the design and type of heating system must be given careful consideration if satisfactory and economical operation are to result.

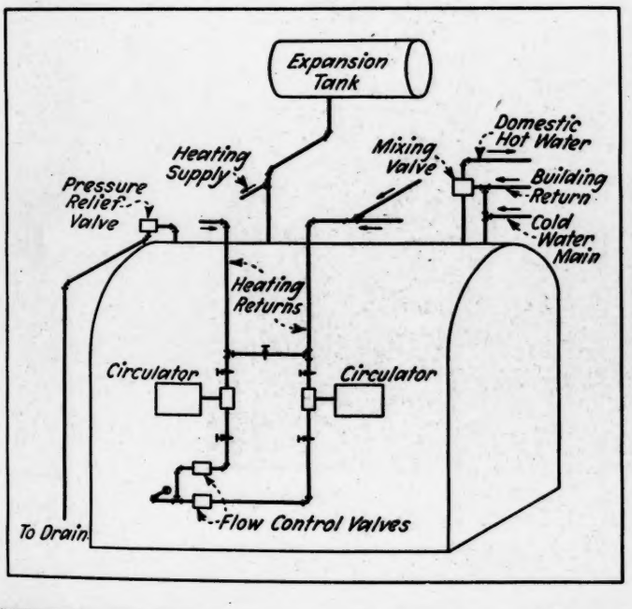
An excellent example of a low-cost heating system with a low-operating cost is the system installed in the Colonnades Apartments, 40-39 48th St., Sunnyside, Long Island, N. Y. The building, which was opened about a year ago, is constructed of brick, four stories high with 31 apartments and about 70 rooms. The rooms are all large with the living room averaging about 18 x 11 ft. The number of rooms per apartment ranges between 1½ and 4 while the rent averages about $55 to $60 for 3-room apartments.

The heating system is a one-pipe pressure hot water system with a single steel boiler in the basement boiler

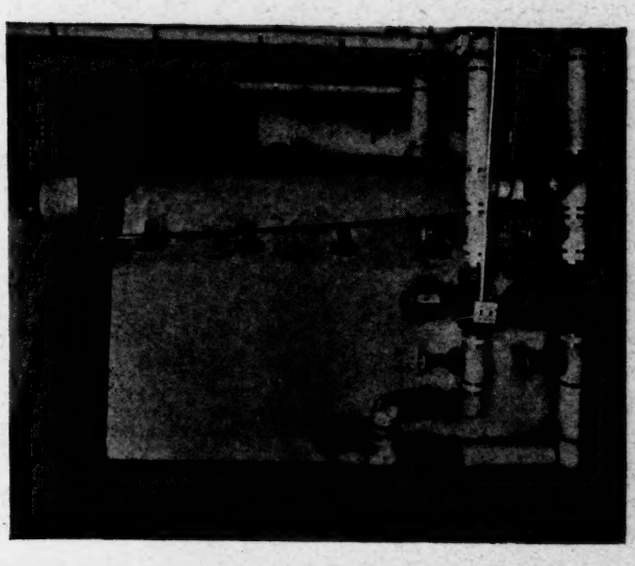


The Colonnades Apartment House at Sunnyside, Long Island, New York.

Arrangement of piping on the hot water boiler. Two manual switches are used to control the operation of the circulators. A thermostatic mixing valve is used to regulate the temperature of the domestic hot water.



Hand-fired coal boiler which is used to supply both heating hot water and domestic hot water. Heating system is divided into two circuits, one serving front of house and the other the back.



room and cast iron convectors in each room. Rice anthracite coal is fired manually and the owner reports the fuel consumed was about 14 tons per month during the winter months. This is considerably less than the consumption in similar buildings under the same management.

The basement heating mains are arranged in two double loops, one loop supplying the front of the building and the other the back. Risers and returns are taken off these loops with special fittings which are designed to force the correct amount of water through the branch risers and back to the returns to the mains. Shut-off valves have been installed on each riser and return to make it unnecessary to drain the entire system in case of a leak.

The ends of each double loop are joined and the two returns are then connected to forced circulation pumps located on the side of the boiler. To balance the flow of water through each branch of the loop, square head plug cocks have been installed in each return just before they are joined. By adjusting these cocks the flow through each branch of the loop can be balanced.

The operation of the circulating pumps is controlled by manually-operated switches mounted in a small panel on the side of the boiler. One pump draws the water from the front house circuit while the other draws from the rear house circuit.

After the water leaves the pumps it flows through two flow control valves, a tee where the two returns are joined and then into the boiler. The flow control valves serve to stop the circulation of water due to natural convection when the pumps are not operating.

Domestic hot water is heated by an instantaneous hot water coil submerged in the boiler water. The hot water is mixed with the cold city water and building return water by an automatic mixing valve.

The building is owned by the Polk-Junction Corporation, and the heating system was installed by Charles Loughlin, Inc., Jamaica, N. Y. W. P. Manning is the superintendent.

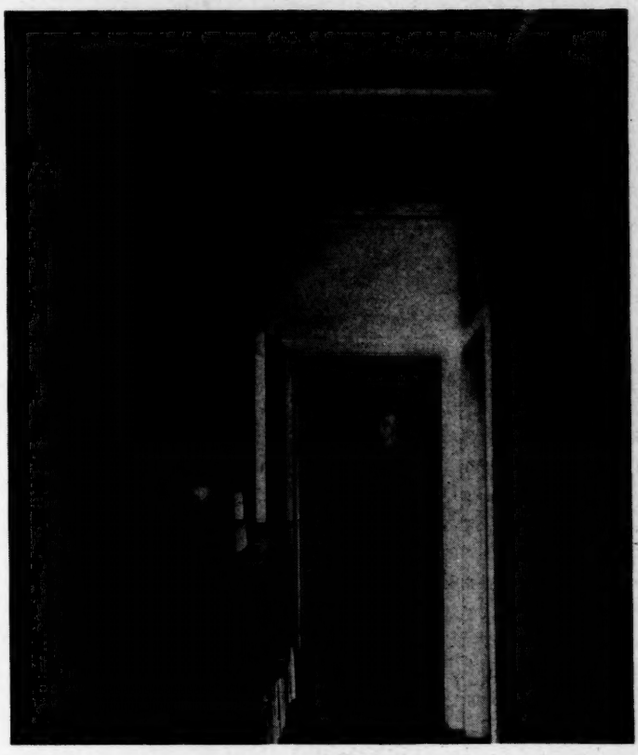
A corner of a typical apartment showing convector. A hand regulating valve is supplied on each convector so that the tenant can control the room temperature.

Cool Night Air for Daytime Comfort

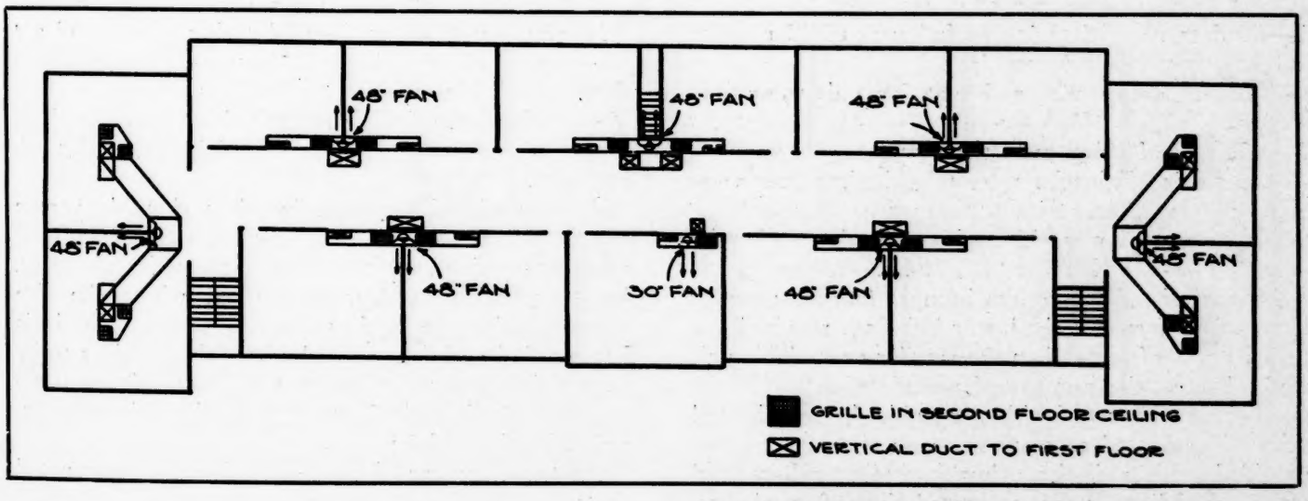
ESPECIALLY in the South and Southwest use of night air for securing an effective degree of cooling in apartments is growing rapidly. When night temperatures are low the passage of large amounts of the cool night air through living or sleeping quarters permits taking away in the air stream a large part of the heat brought into the building during the hot daytime hours. The result is that the rooms and structures do not accumulate large quantities of heat. With suitable operation this method can maintain temperatures sensibly lower than those outside.

Methods of adapting this method to apartment houses are diverse. When buildings are being planned or are under construction it is a simple matter to arrange space for the necessary fans and this practice is being followed to an increasing degree. In existing buildings portable units for mounting in doorways or in windows are now available. Of greatest importance in arranging for the use of any of these methods of ventilation is the provision of adequate air volume. Practice is to use as much air as possible with the statement sometimes made that the minimum amount necessary is 30 changes of air per hour or one every two minutes. Instances of fans sized to handle double this amount of air are not uncommon.

When properly planned, installed and operated these same ventilating fans can be used not only for cooling in summer but also as a general exhaust to withdraw cooking odors and stale air throughout the building.



(Top) Exterior view of two-story Farnsworth Apartment in New Orleans where (above) grilles in the hall ceilings are connected to motor-driven propeller fan in the attic. Fan operation is under tenant control.



(Right) Exterior of the 30-family Carolina Apartment in Houston, Texas. (Above) Floor plan showing how fans and ducts are arranged. There are seven 48-in. propeller type fans and one 30-in. fan, all located in the attic.

Statistics on Fuel Used for Heating

How much fuel should be used in a well operated heating plant in an apartment house? Of all the estimating methods in existence for answering this question the most convincing is based on figures obtained from plants actually being operated at the present time. The author shows that for New York conditions the fuel used varies with the size of the house. The smaller houses require more fuel per room than the large ones. But the amount of fuel used for heating the service hot water is practically constant regardless of the size of the building.

REAL estate appraisers, building owners and building managers are constantly inquiring how much fuel will be required for heat and for hot water in a given apartment house. It is an important question, since fuel is a major item of operating expense.

There are several methods used to estimate fuel consumption, some of which are reasonably accurate, but the most reliable one is generally felt to be the comparison of the building with actual results for a similar structure. It is the purpose of this article to set forth actual figures on fuel consumption compiled from a wide range of New York apartment houses, and to resolve therefrom average results which may be used as guides in estimating.

The following data cover 44 buildings heated by coal and 12 others heated by oil. The operation of these heating plants was supervised by a single organization, so that the methods of observation and fuel recording were the same in all cases. Furthermore, they were all subject to the following conditions:

1—All data covered the same full year of 12 months, comprising 5000 degree days,
2—Building occupancies and heat demands were similar,
3—Methods of firing were the same,
4—Operating efficiencies were brought into line so as to represent first-class performance,
5—All coal used was either rice or barley anthracite and all oil was Bunker "C", No. 6.

An analysis of the results brought out the more or less obvious fact that the larger buildings required less fuel per unit of space than the smaller ones. This unit was taken as the number of pounds of coal (or the number of gallons of oil) per cubic foot of heated space. The heated space was considered as that space provided with radiation, thus excluding cellars and attics. Buildings were separated into five classes, based on the total cubic contents of heated space, thus:

Class I, 900,000 cu. ft. and upward,
Class II, 700,000 to 900,000,
Class III, 500,000 to 700,000,
Class IV, 300,000 to 500,000,
Class V, 100,000 to 300,000.

Due to the fact that data on cubic contents of heated space are not often readily available, but that figures on the number of rooms in a given house are usually known, the results are expressed in tons of coal (or in gallons of oil) per room for quick estimating purposes. The error thereby introduced, caused by variation in room size, was found to be so small as to be of no importance for all practical purposes.

As regards the unit of fuel consumption for domestic hot water, it was apparent that the most accurate one was the number of tons of coal (or of gallons of oil) per bath. Hot water consumption in laundries was found to bear a uniform ratio to the number of apartments and was so small a variation as to be ignored for our purposes.

The first tabulations cover coal burning plants. The buildings are separated into five classes, as explained above, and are listed in Tables 1 to 5, inclusive.

The next data cover the oil burning plants, and are also separated into classes. However, there were no figures available on buildings in Class IV and in Class V, therefore, the field was limited to the first three classes. These results are tabulated in Tables 6 to 8, inclusive.

An analysis of the foregoing data showed average results as indicated in Table 9, which may be used for ready estimating purposes. Specific cases can, of course, be compared for closer estimating, where the size characteristics are similar. In this connection, it is suggested that 5% be added where the building to be figured has unusually severe exposures. Tonnage results for No. 1 Buckwheat or pea coal will be comparable with those given.

From the Summary of Results in Table 9 it was noted that:

1—The larger the building, the smaller the amount of fuel used per unit of space,
2—The amount of fuel per bath is practically constant for all classes of apartment buildings.

Apartment Houses in New York

TABLE 1.—FUEL CONSUMPTION OF CLASS I COAL HEATING PLANTS
(900,000 Cu. Ft. and Over)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Tons, Coal Used: Heat	Hot Water	Total
Coal Bldg. No. 1..	911,700	61	263	76	380	95	475
Coal Bldg. No. 2..	923,600	109	370	105	353	160	513
Coal Bldg. No. 3..	901,300	105	350	105	290	150	440
Coal Bldg. No. 4..	957,000	121	406	121	310	180	490
Coal Bldg. No. 5..	918,400	81	265	81	312	132	444
Coal Bldg. No. 6..	934,200	88	288	88	313	120	433
Coal Bldg. No. 7..	902,500	103	327	103	300	175	475
Coal Bldg. No. 8..	925,100	97	350	97	335	155	490
Coal Bldg. No. 9..	1,320,000	108	495	200	600	216	816
Coal Bldg. No. 10..	915,000	92	330	92	350	155	505
Total	9,308,800	—	3,444	1,068	3,543	1,538	5,081

TABLE 2.—FUEL CONSUMPTION OF CLASS II COAL HEATING PLANTS
(700,000 to 900,000 Cu. Ft.)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Tons, Coal Used: Heat	Hot Water	Total
Coal Bldg. No. 11..	775,300	84	286	84	283	132	415
Coal Bldg. No. 12..	882,600	78	262	78	230	115	345
Coal Bldg. No. 13..	724,300	78	251	78	250	127	377
Coal Bldg. No. 14..	729,300	68	260	68	250	128	378
Coal Bldg. No. 15..	701,100	67	224	67	242	84	326
Coal Bldg. No. 16..	822,700	83	195	83	238	84	322
Coal Bldg. No. 17..	860,400	84	250	84	290	104	394
Coal Bldg. No. 18..	738,000	84	280	84	290	120	410
Coal Bldg. No. 19..	704,400	84	284	84	255	84	339
Coal Bldg. No. 20..	852,800	79	285	79	323	110	433
Coal Bldg. No. 21..	831,000	91	239	104	305	140	445
Coal Bldg. No. 22..	803,750	66	231	66	210	114	324
Totals	9,425,650	—	3,047	959	3,166	1,342	4,508

TABLE 3.—FUEL CONSUMPTION OF CLASS III COAL HEATING PLANTS
(500,000 to 700,000 Cu. Ft.)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Tons, Coal Used: Heat	Hot Water	Total
Coal Bldg. No. 23..	609,500	55	200	55	181	80	261
Coal Bldg. No. 24..	501,900	53	195	53	219	100	319
Coal Bldg. No. 25..	592,800	54	212	54	210	88	298
Coal Bldg. No. 26..	676,200	53	230	76	274	100	374
Coal Bldg. No. 27..	665,800	57	227	57	265	100	365
Coal Bldg. No. 28..	547,200	48	151	48	211	80	291
Coal Bldg. No. 29..	574,500	48	168	48	190	75	265
Coal Bldg. No. 30..	557,000	61	226	61	260	90	350
Coal Bldg. No. 31..	756,000	59	220	59	232	84	316
Coal Bldg. No. 32..	683,625	60	212	60	256	90	346
Totals	6,194,525	—	2,041	571	2,298	887	3,185

TABLE 4.—FUEL CONSUMPTION OF CLASS IV COAL HEATING PLANTS
(300,000 to 500,000 Cu. Ft.)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Tons, Coal Used: Heat	Hot Water	Total
Coal Bldg. No. 33..	434,000	55	171	55	181	72	253
Coal Bldg. No. 34..	413,000	34	122	40	146	80	226
Coal Bldg. No. 35..	303,200	32	99	32	140	39	179
Coal Bldg. No. 36..	305,700	37	92	37	130	46	176
Coal Bldg. No. 37..	498,300	48	160	48	240	68	308
Totals	1,954,200	—	644	212	837	305	1,142

TABLE 5.—FUEL CONSUMPTION OF CLASS V COAL HEATING PLANTS
(100,000 to 300,000 Cu. Ft.)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Tons, Coal Used: Heat	Hot Water	Total
Coal Bldg. No. 38..	214,100	27	79	27	94	36	130
Coal Bldg. No. 39..	289,000	40	110	40	136	42	178
Coal Bldg. No. 40..	119,000	12	36	12	55	23	78
Coal Bldg. No. 41..	130,000	12	39	12	74	15	89
Coal Bldg. No. 42..	141,500	17	56	17	53	24	77
Coal Bldg. No. 43..	210,000	24	83	24	117	32	149
Coal Bldg. No. 44..	189,600	17	54	17	67	30	97
Totals	1,293,200	—	457	149	596	202	798

TABLE 6.—FUEL CONSUMPTION OF CLASS I OIL HEATING PLANTS
(900,000 Cu. Ft. and Over)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Gallons, Oil Used: Heat	Hot Water	Total
Oil Bldg. No. 1	1,392,200	126	495	126	79,900	39,600	119,500
Oil Bldg. No. 2	1,351,700	105	448	119	89,000	31,000	120,000
Oil Bldg. No. 3	1,015,400	100	402	100	77,000	26,000	103,000
Totals....	3,759,300	—	1,345	345	245,900	96,600	342,500

TABLE 7.—FUEL CONSUMPTION OF CLASS II OIL HEATING PLANTS
(700,000 to 900,000 Cu. Ft.)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Gallons, Oil Used: Heat	Hot Water	Total
Oil Bldg. No. 4	763,000	37	197	65	47,500	18,000	65,500
Oil Bldg. No. 5	893,100	66	255	66	49,000	18,000	67,000
Oil Bldg. No. 6	757,000	74	245	74	45,000	20,000	65,000
Totals....	2,413,100	—	697	205	141,500	56,000	197,500

TABLE 8.—FUEL CONSUMPTION OF CLASS III OIL HEATING PLANTS
(500,000 to 700,000 Cu. Ft.)

Building	Heated Space, Cubic Feet	Number of Apts.	Number of Rooms	Number of Baths	Gallons, Oil Used: Heat	Hot Water	Total
Oil Bldg. No. 7	564,400	66	185	66	34,400	21,600	56,000
Oil Bldg. No. 8	539,100	54	159	54	41,000	14,000	55,000
Oil Bldg. No. 9	695,400	65	210	65	42,500	18,000	60,500
Oil Bldg. No. 10	554,000	54	178	65	35,900	18,600	54,500
Oil Bldg. No. 11	504,000	40	119	41	29,000	8,500	37,500
Oil Bldg. No. 12	600,000	29	140	46	30,000	14,000	44,000
Totals	3,456,900	—	991	337	212,800	94,700	305,500

TABLE 9.—SUMMARY OF RESULTS OF FUEL CONSUMPTION STUDY

Building (Class and Cubic Contents of Heated Space)	Coal Plants (Tons of Coal): Per Room for Heat	Per Bath for Hot Water	Oil Plants (Gallons of Oil): Per Room for Heat	Per Bath for Hot Water
Class I, 900,000 and upwards.	1.02	1.44	183	280
Class II, 700,000 to 900,000..	1.04	1.40	202	273
Class III, 500,000 to 700,000.	1.12	1.55	214	281
Class IV, 300,000 to 500,000..	1.30	1.44	—	—
Class V, 100,000 to 300,000...	1.31	1.36	—	—

Hand Firing with Small Anthracite Applied to Apartment Houses

By HOBART L. LITTELL†

A method of burning small size anthracite by hand firing of a large fuel charge at long intervals has been successfully applied in apartment houses in Eastern cities. Attention to fires is small with but one stoking per day in cold weather and one per week in summer. Operating results in these apartment houses are presented.

AN improved method of hand firing anthracite in commercial installations has come into extensive use during the several years past. This combustion system was the subject of a paper presented by the author at a conference at Lehigh University in April, 1938. Since then additional case histories have been recorded as applied to all sorts of buildings including apartments, institutions, schools, and in commercial and industrial structures. Of these numerous case histories we shall consider only apartment houses and will include in this article a 30-family, 6-story, elevator house (in which this system replaced other combustion methods) and the fuel and heating history of the modern 3-unit group illustrated. It is felt that the application scope of this combustion system can be well visualized by this method of presentation.

What the System Consists of

A distinctive feature of this method of combustion is that by its use and with suitable controls it is possible to greatly lengthen firing periods. The method has been developed so that using rice or barley anthracite in a single heavy manual firing the fuel charge will last from 12 to 48 hours in coldest weather and a week in summer for hot water. The firebox of the boiler is used as a combination burning space and *hopper* of reserve fuel although nothing is done to the firebox nor is anything installed therein except dumping, heavy construction, side and end lapped pin hole grates with suitable air openings of approximately 8% of the grate area. Because varying degrees of free air flow through the fire are necessary for the successful functioning of this system, a propeller type of fan is necessary. The diffusing action of this type of impeller produces a desirable air distribution under the grates. The ash pit is moderately deepened to provide ash capacity without injuring grates and assuring a free air movement at all times.

Control is by a program clock, steam, water and stock switches and a variable speed rheostat for the blower motor. The accomplished result is a steadier production of heat but only on demand of the building and of the routine of the building personnel. An initial

TABLE 1

Building	29 So. Munn	33 So. Munn	7 Chestnut
In Service	Aug., 1936	Nov., 1937	Aug., 1937
Apartments	43	35	46
Rooms	156	100	140
Est. Cube	650,000	430,000	540,000
C.I. Radiation, Sq. Ft.	6,050	4,700	5,400
Combined E.D.R., Sq. Ft.	9,815	7,375	8,850
S.H.B.I. Boiler Rating	12,000	10,200	12,000
Grate Area, Sq. Ft.	27.0	27.0	32.5
Heating System	High Vacuum System Throughout		
Hot Water System	Submerged Coils in Boilers		
Winter Consumption Ave.	190 tons	154 tons	200 tons
Annual Consumption Ave.	210 tons	170 tons	225 tons
Annual Tons Per 100 E.D.R.	2.15	2.16	2.54
Pounds Coal Per Cubic Foot	0.65	0.79	0.835

†Anthracite Institute, New York.

ignition timer switch is also used for the firing period and for a predetermined time thereafter. After ignition is accomplished (which is usually within a half hour), the regular routine controls take over the operation.

The inherent smokeless characteristics of anthracite, the fact that combustion of anthracite takes place within the fuel bed and the nature of anthracite steam coal ash make this system a clean one to use in residence areas. Combustion within the fuel bed permits free and unrestricted use of the furnace volume for the heavy burden of coal loaded into the furnace at one time. It makes the system adaptable to any conventional firebox whether cast iron, steel or refractory walls are used. The burning rate per sq. ft. of grate per hr. permissible with this system is adequate for any heating plant requirement. Power costs average 15 cents per ton. Maintenance costs are less than $10.00 per boiler per year. The only moving part is the blower-motor shaft. The operation of the blower is decidedly intermittent and in reality natural draft plays a great part in routine operation but the blower is an indispensable part of the complete system.

Located on a high exposed spot in Jersey City, N. J., is a 6-story elevator house of 30 apartments or 131 rooms with properly heated basement service rooms, mostly above grade. Served by a compact steel boiler the two pipe pumped low vacuum system and submerged hot water coils represent a total E.D.R. load of 6200 sq. ft. served by a 22.5-sq. ft. grate area. Firing once in 24 hours in severe weather and every 7 days in summer, the superintendent retires and rises as he pleases but the heat and hot water are supplied according to service demands through the functioning of the automatic controls. In this building the fuel consumption per room per year for all purposes averages 1.28 tons or 2.8 tons per 100 ft. E.D.R. at an annual cost of $8.00 per room.

The East Orange, N. J., garden group illustrated consists of 3 buildings cared for by one fireman. As firing is done only once a day in severe weather and once a week in summer, labor is easily distributed. Rice anthracite is used during the heating season and barley is used for summer hot water. Table 1 gives detail data on this group.

Six pounds of anthracite per apartment per average summer day supplies all hot water through a pumped circulation system.

The greater consumption per cubic foot at 33 S. Munn Avenue is due to a long building, whereas 29 is a compact building. The still higher consumption in the Chestnut St. house is due to distribution troubles which necessitate boiler operation on an average one hour earlier and one half hour later than the other buildings. The hot water fuel requirements per dwelling unit average the same.

It will be noted that long firing periods are the rule with this system and decidedly reasonable costs are attained. Space limitations prevent elaboration but cases recorded are truly typical of results obtained with this combustion system.

Oil Burner Saves Money in Apartment

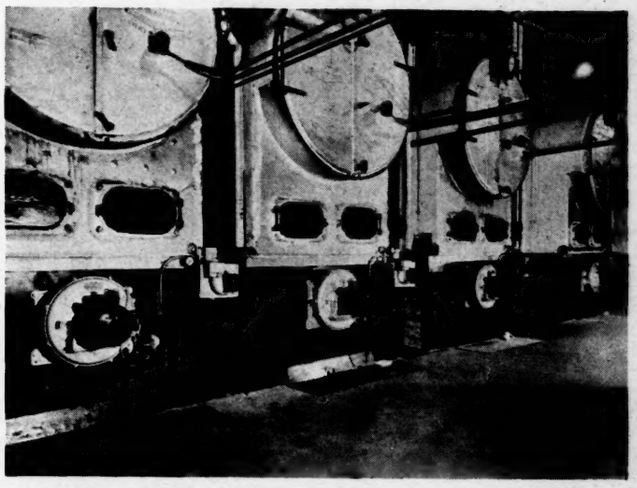
SAVINGS in both fuel and operating costs are reported by the management of the 30-story Majestic Apartments, 72nd Street and Central Park West, New York City, one of the largest apartment house buildings in the Metropolitan area, since they took over the operation of their own boiler plant about 20 months ago.

Previous to the installation of its own boiler room the buildings had depended on outside steam pipe equipment for heat. The boiler room installation was designed by Jaros, Baume & Bolles, consulting engineers, in cooperation with Brown, Wheelock, Harris, and Stevens, Inc., real estate management.

Four low pressure steel boilers were installed in the basement and set on a 54-inch red brick base lined with firebrick. Each boiler is fired by a full automatic No. 6 Todd oil burner completely equipped with modutrol controls. Installation of the burners was made by the Breuer Engineering Company, Inc.

The installation has been in operation for nearly two years and figures for the first year of operation show that 592,000 gallons of oil, which cost $18,550, were consumed. These figures include all the maintenance, labor, gas and electricity in connection with the boiler plant and represent a saving of $27,850 over the previous equipment.

The entire investment in boiler and oil burners was paid for in less than sixteen months. The superintendent reports complete satisfaction with the new oil burning system and states that the boiler plant is giving better service.



The Flow of Air and Its Distribution Through Ducts

Part 6—Fan Laws and Fan Selection

By J. R. ZWICKL†

Fan Laws and Fan Selection

Fan Laws: In order to be able to select a fan intelligently it is necessary to understand the basic fan laws.

The driving force that moves the air through the fan is primarily due to the centrifugal force of that air mass which is momentarily enclosed in the rapidly rotating wheel. As a centrifugal force, its intensity increases as the second power of the rotative speed of the wheel. By combining all constants we can write for the head or pressure developed by the fan, the general equation:

$$h_s = Amn^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (39)$$

where m is the true density of the air in the fan and n = r.p.m. of the fan. This is the *first fan law,* and can be stated: *The pressure (or head) produced by the fan varies as the square of the fan speed and directly as the air density.*

If in equation (39) we substitute m by means of equation (7) we can write:

$$h_s = (Am_o n^2)\left(\frac{b}{b_o}\right)\left(\frac{T_o}{T_t}\right) = (h_s)_o\left(\frac{b}{b_o}\right)\left(\frac{T_o}{T_t}\right)$$

$$h_s = (h_s)_o\left(\frac{m}{m_o}\right) \quad \ldots\ldots\ldots\ldots\ldots (39a)$$

where T_t is the absolute temperature of the air in the fan and $(h_s)_o = Am_o n^2$ is that static pressure the fan would produce with air of standard density. This $(h_s)_o$ we may call the *apparent fan pressure* for any non-standard condition. Equation (39a) we can write as:

$$\frac{(h_s)\,T_t}{b_t} = \frac{(h_s)_o\,T_o}{b_o} = constant \quad \ldots\ldots\ldots\ldots (39b)$$

as a convenient relation for the static head produced by the fan under any temperature and barometer condition (with constant speed).

From all the previous discussions it is evident that when air moves through a duct system, the pressure required for driving a certain air volume (Q c.f.m.) through the system, very closely varies as the second power of this volume. Thus:

$$H' = BmQ^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (40)$$

and this is the basic law for the *system resistance.* Q is the actual (true) air volume in c.f.m. and m the true density of the air for the conditions *in the duct.* (B is a constant.)

It is also evident that when a fan is coupled to a duct system, the flow Q will be so much and only so much as the available fan pressure can drive through the given system. This means that:

$$Amn^2 = h_s = H' = BmQ^2$$

from which follows *the second fan law:*

$$Q = n\sqrt{\frac{A}{B}} = Cn \quad \ldots\ldots\ldots\ldots\ldots\ldots (41)$$

which is stated as: *The flow through a fan in c.f.m. varies linearly with the fan speed.* We see that m, the density of the air, disappeared from the formula, which simply means that the air volume handled by the fan is independent of the air density. In other words *with a given speed the fan will always drive through a given fixed system the same air volume (in c.f.m.), whatever the air density is.* This is so because, although the pressure developed by the fan increases directly with the density, the resistance offered by the duct does so, too; consequently they balance each other.

If the air density in the duct system (m_d) is different from that in the fan (m_t), then equation (41) modifies into:

$$Q = n\sqrt{\frac{Am_t}{Bm_d}} = Cn\sqrt{\frac{m_t}{m_d}} = Cn\sqrt{\frac{T_d}{T_t}} \quad \ldots\ldots (41a)$$

where T_d and T_t are the absolute temperature of the air in the duct and fan, respectively. (The influence of the barometric pressure on m falls out, since b is the same for both.) If the ratio $(m_t/m_d) = (T_d/T_t)$ stays constant, the linear variation of Q with n holds true.

The weight of the air handled by the fan is:

$$G = Qm = cnm \quad \ldots\ldots\ldots\ldots (41b)$$

At constant speed this weight of the air varies linearly with the air density m, since Q itself is independent of the air density and changes only when n changes.

Strictly speaking, this second law is true only to the extent that the efficiency of the fan remains the same during such variations of Q and n. To a certain degree this is so, because Q and n change in the same ratio. Therefore, all the angles in the inlet and outlet velocity diagram remain constant, meaning theoretically a constant efficiency.

If, in equation (39), we eliminate the speed n by means of equation (41) or (41b) this formula modifies into:

$$h_s = A_1 mQ^2 = A_1\frac{G^2}{m} \quad \ldots\ldots\ldots\ldots\ldots (39b)$$

where Q is the actual air volume in c.f.m., $G = Qm$ is its weight, and m is the true density of air in the fan.

For the *fan horsepower* we have found equation (11). By substituting $(h + h_s) = h_t = h_s\,(1 + a)$ and h_s by means of equation (39), and Q by means of equation (41), we can write:

$$N = Fmn^3 \quad \ldots\ldots\ldots\ldots\ldots\ldots (42)$$

†Worthington Pump & Machinery Corp., Carbondale Division, Harrison, N. J.

as the third fan law: *the fan horsepower varies as the third power of the fan speed and directly as the density.*

In equation (42) m is the true density of the air *in the fan.* If we substitute h_s by equation (39a), we can write:

$$N = (Fm_o n^3)\left(\frac{b}{b_o}\right)\left(\frac{T_o}{T_t}\right) = N_o\left(\frac{b}{b_o}\right)\left(\frac{T_o}{T_t}\right)$$
$$= N_o\left(\frac{m}{m_o}\right) \ldots\ldots\ldots\ldots\ldots\ldots (42a)$$

where $N_o = Fm_o n^3$ is the fan horsepower for standard air density. T_t is, as before, the absolute temperature of the air *in the fan.* This equation shows clearly that the fan horsepower varies directly as the barometric pressure and inversely as the absolute temperature of the air in the fan.

If in equation (42) we eliminate the speed n by means of equation (41) or (41b), this modifies into:

$$N = F_1 m Q^3 = F_1 (G^3/m^2) \ldots\ldots\ldots\ldots\ldots (42b)$$

where Q is the actual air volume in c.f.m., G the weight of this volume $(G = Q_o m_o = Qm)$ and m the true density *in the fan.* This is another useful formula for N.

To illustrate the real meaning of these fan laws, assume we have a fan coupled to a duct system of fixed dimensions. At standard conditions (t = 70F and $b = b_o = 29.92$ in. of mercury) the fan delivers into this duct, say, 10,000 c.f.m. air; the static head is found to be $(h_s)_o = (H')_o = 0.75$ in. of water and the horsepower $N = N_o = 2$ hp. If this *fan and duct system* is moved to a high elevation, where $b = 25$ in. of mercury and $t = 60$F, the fan will again deliver 10,000 c.f.m. into this duct (provided it runs with the same speed). However, under these conditions the static head will be only $h_s = (h_s)_o\left(\frac{m}{m_o}\right) = 0.638$ in. and the horsepower $N = N_o\left(\frac{m}{m_o}\right) = 1.7$ hp., since m is only $0.85m_o =$ 0.0638 lb. per cu. ft. The weight of the air handled by the fan will fall from 750 lb. per min. to 638 lb. per min.

If it is required that the fan shall deliver the same weight of air, then the flow must be increased from 10,000 c.f.m. to $\frac{10{,}000 m_o}{m} = 11{,}750$ c.f.m. To attain this, the speed must be increased to 1.175 times the original speed. This new speed will increase the static head to $0.638\ (1.175)^2 = 0.88$ in. and the horsepower to $1.7 \times (1.175)^3 = 2.76$ hp. Had we moved the fan and the duct to a lower level, say into a mine, just the reverse would take place.

The previously quoted fan laws quite naturally hold true only for the fan together with its (unchanged) duct system. If the duct system is changed, a new equilibrium will be established. If the fan runs at constant speed, the static pressure developed by the fan varies with the flow, i.e. $h_s = f(Q)$; this curve has the general form of the curve h_s in Fig. 4. On the other hand, the system resistance $H' = f(Q)$, as given by equation (40), has the form as curve H'. Where these two curves cross, $h_s = H'$, is the point at which the fan will operate with the given system. Changing the speed means another (higher or lower) $h_s = f(Q)$ curve, which will cut the $H' = f(Q)$ curve at such Q value as corresponds to the new speed according to equation (41); the point of operation moves up and down along the line $H' = f(Q)$.

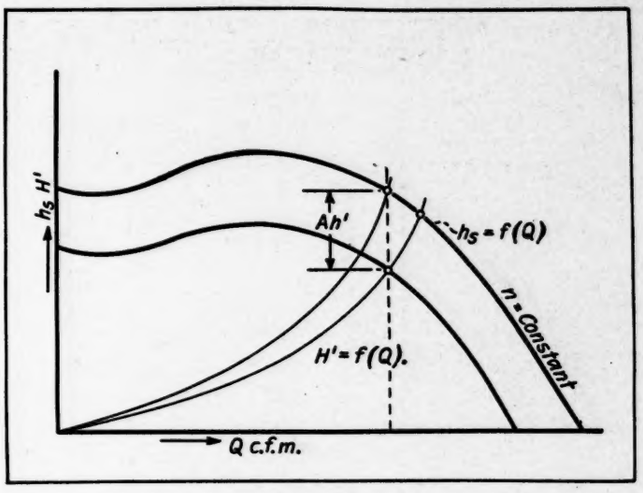


Fig. 4.

If we change the duct system by adding a resistance (say a damper), the curve $H' = f(Q)$ will be steeper, the point of operation moves up along the original curve $h_s = f(Q)$. The distance $(\Delta h')$ is the pressure drop caused by the resistance of the damper. This is an easy way of regulating the flow, but uneconomical, since the fan has to drive the full air volume Q against this added resistance $\Delta h'$. The regulation of the flow by varying the speed (via a variable speed drive) is far superior.

Fan Selection: The fan must be capable of delivering the specified amount of air with such static head as is required to drive this air through the duct system. The air quantity is usually specified as Q_o c.f.m. (for the standard 70F and $b = b_o = 29.92$ in. condition) or as $G = Q_o m_o = Qm$ lb. per min. As the air passes through the system, its temperature undergoes certain changes, such as cooling or heating. In general, the temperature of the air in the fan is different from that in the duct; thus also its volume: $Q_t = G/m_t$ and $Q_d = G/m_d$ where m_t and m_d is the density of the air for the fan and duct conditions respectively. See equation (7).

As shown in equation (41) the air volume delivered by the fan does not vary when the density changes. For this very reason we must select our fan size according to *the air volume Q_t in the fan* and not for Q_o, although the fan tables are based on standard air density.

The resistance H' of the system depends on the true velocities and true densities of the air in the duct. Therefore the computing of H' and $(H')_o$ must also be based *on the air volume Q_d in the duct* and not on Q_o.

Having computed the system resistance $(H')_o$ and H', respectively, by means of equations (38) and (38b), we can select the fan from the manufacturer's tables. These tables are usually arranged so that they give the fan speed, which is required in order that the fan shall develop a given static pressure when handling a specified air volume. It should be kept in mind that these static pressures, as specified in the tables, are based on standard air density conditions; they are the $(h_s)_o$ values of equation (39a) and represent the true static

TABLE 7—REPRESENTATIVE SPEEDS AND VELOCITIES FOR CENTRIFUGAL FANS
(From Refrigerating Data Book, 1937-38, The American Society of Refrigerating Engineers)

Static Pressure, In. of Water	Forward Curved Blade Fans		Backward Curved Blade Fans	
	Outlet Velocity, Ft. per Min.	Tip Speed, Ft. per Min.	Outlet Velocity, Ft. per Min.	Tip Speed, Ft. per Min.
0.250	1000-1100	1500-1700	1000-1100	3300-3700
0.375	1000-1100	1700-1900	1000-1100	3700-4100
0.500	1000-1200	1900-2100	1100-1300	4100-4500
0.625	1100-1300	2100-2400	1100-1300	4500-4700
0.750	1200-1400	2400-2700	1100-1300	4700-4900
0.875	1300-1600	2700-2900	1100-1200	4700-4900
1.00	1400-1800	2900-3100	1000-1100	4900-5100
1.25	1700-1900	3100-3400	1000-1100	5000-5200
1.50	1800-2100	3400-3800	1000-1100	5200-5600
1.75	1900-2300	3800-4200	900-1000	5600-6000
2.50	2200-2600	4200-4500	—	—
2.25	2400-2800	4500-4700	—	—
2.50	2600-3000	4700-4900	—	—

head only if the air temperature in the fan is equal to T_o (assuming $b = b_o = 29.92$ in. standard pressure). We may designate this $(h_s)_o$ as the *nominal* or the *fan table static*. If T_f is different from T_o, then h_s can be larger or smaller than $(h_s)_o$, depending on whether T_f is smaller or larger than T_o.

Under all conditions the true actual static head h_s developed by the fan must be equal to the true H' system resistance. From this $h_s = H'$ we can figure backward with equation (39a) and find the corresponding $(h_s)_o$ value, for which we must select the fan speed from the tables. We find:

$$(h_s)_o = H'(b_o/b)\ (T_f/T_o) \quad \ldots\ldots\ldots\ldots (43)$$

where b is the existing barometric pressure and T_f the absolute temperature *of the air in the fan.*

If in equation (43) we substitute H' by means of equation (38b) and consider that the barometric pressure b is the same for any part of the fan-duct system, we can write:

$$(h_s)_o = (H')_o\ (T_f/T_d) \quad \ldots\ldots\ldots\ldots (43a)$$

where $(H')_o$ is the apparent system resistance for standard density but true velocity; see equation (38). It is evident from equation (43a) that when and only when $T_f = T_d$, i.e., when the air temperature is the same for fan and duct, can we select the fan directly for the apparent system resistance. In any other case $(h_s)_o$ must be figured via equation (43) or (43a).

Strictly speaking, equations (43) and (43a) hold true only for the case when the temperature T_d is the same throughout the whole duct. If this is not so, as for instance when the fan is located between the return and supply duct, then we divide the whole duct system into subdivisions according to the prevailing temperature; for each such subdivision we figure its own $(H')_o$ and the corresponding part of $(h_s)_o$ as per equation (43a). The sum for all subdivisions in series will give the final value for $(h_s)_o$. Since the fan temperature T_f is the same for all subdivisions, we can write:

$$(h_s)_o = \Sigma[(H'_x)_o/T_x]\ T_f \quad \ldots\ldots\ldots\ldots (43b)$$

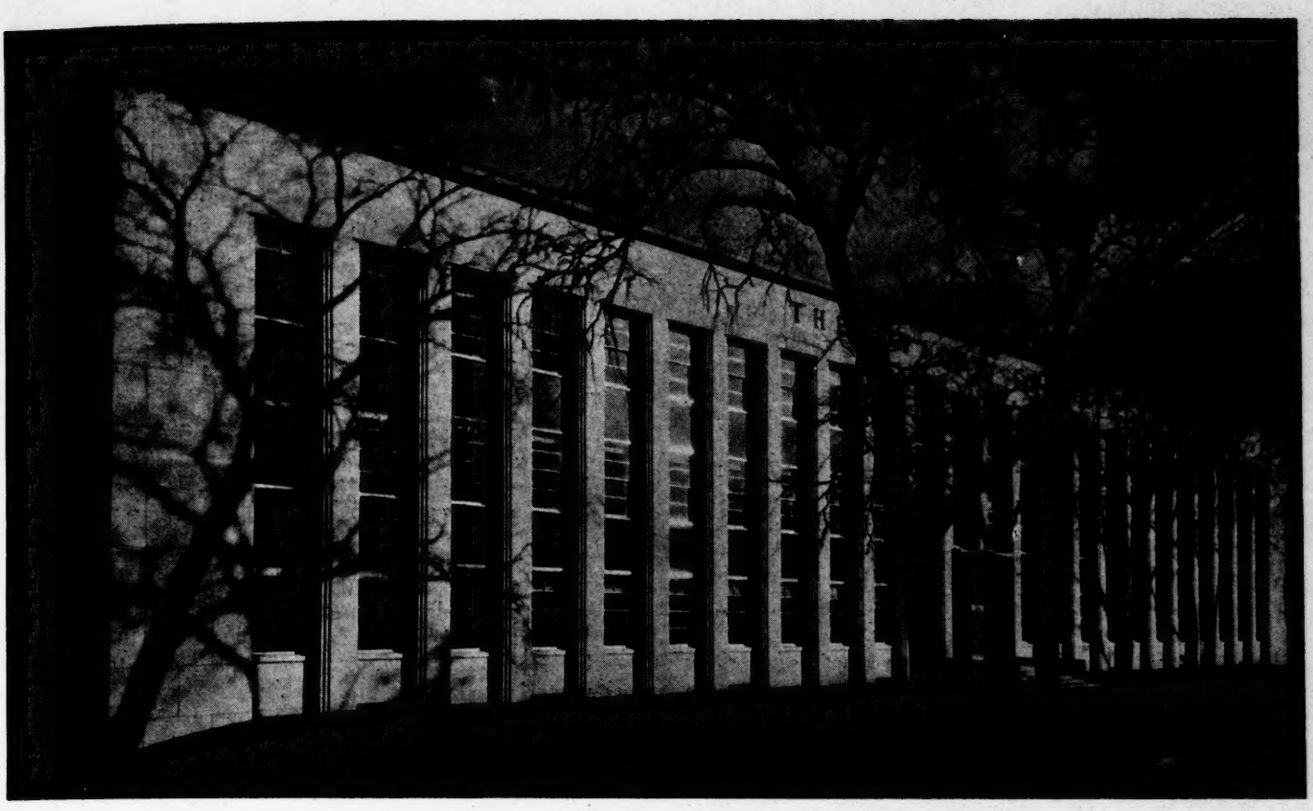
as the final nominal or fan table-static for which we have to find the proper fan speed. In equation (43b) $(H'_x)_o$ is the apparent resistance of subdivision x, for which the absolute temperature T_x is constant throughout. It is figured *for standard density* ($m = m_o$) and for *true velocities*, based on the actual volume of the air under the prevailing barometric pressure b and temperature t_x in subdivision x.

The fan size is selected for the fan air volume Q_f and according to the fan outlet velocity. Table 7 gives accepted values for this outlet velocity in accordance with the static head required from the fan. With these velocities the fan will operate with reasonable efficiency and will be reasonably quiet.

Next to the fan speed the fan tables give also the fan horsepower for each speed. Just as the pressures are based on standard density, so are the data for the horsepower. Thus they are the N_o values of equation (42a), the nominal horsepower, and must be corrected for the true density m, i.e., for *barometric pressure and temperature in the fan* to get the actual horsepower consumed by the fan under the given conditions. Since the fan horsepower increases linearly with the density, we should figure N for the possible highest pressure and lowest temperature which the air ever can have in the fan, so as to be sure to select the motor large enough.

The data for horsepower in the fan tables usually do not contain the bearing losses; therefore those data must be corrected, so as to get the overall brake horsepower needed by the fan. The simplest way to do this is by multiplying the tabulated values by $\frac{1}{C_m}$, where C_m is the mechanical efficiency of the fan and drive.

This concludes Dr. Zwickl's series of articles on air flow and distribution.



Exterior of office building of Upjohn Co., Kalamazoo, Mich.

Modern Steam Control a Feature of Medicine Manufacturing Plant

SINCE factory heating and air conditioning have become so important in recent years, and since the proper functioning of these installations is essential, descriptions of modern installations in factory buildings are desirable in keeping up to date on what is going on. As one of a series of such cases the June, 1939, issue of HEATING & VENTILATING described the principal features of the plant at the Upjohn Factory. Since that issue appeared we are informed that certain details regarding the way the heating plant operates were otherwise than as stated and since this might lead to misinterpretation regarding the functions of the devices used, attention is now called to these points. For example, orifices were not located in the steam inlets to the radiators since the method of heating used does not require orifices or other retarding devices to balance the system or to prevent circulation of steam through the heating surfaces.

Also, it is believed that the use of the words "differential valve" in one of the drawings and the notation that the vacuum pump operates to maintain a constant difference between supply and return piping might be misleading. It is suggested that a more descriptive name for this device would be "selective controller" since the function of this device is to maintain a variable lower pressure in the return mains than in the supply mains, and accomplishes this through being directly and simultaneously affected by temperature and pressure differences in the return main while unaffected by the pressure difference between the supply and return mains. Fig. 1 indicates the arrangement diagrammatically.

The steam pressure regulating valve used, and illustrated here in Fig. 1, is a combination pressure regulating and control valve, and is affected by the pressure in the heating system as well as by the variable pressure impressed on the control diaphragm by the action of the infiltration thermostat which was illustrated in Fig. 1 on Page 28 of the June issue.

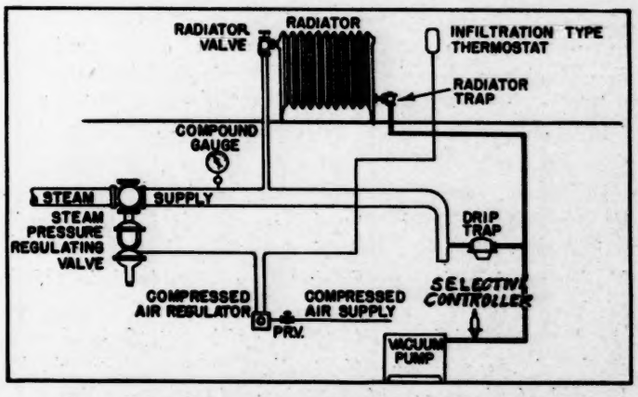


Fig. 1. Control system with thermostat regulating steam pressure at reducing valve.

ABSTRACTS of Current Papers, Books and Pamphlets

Generation of Static Electricity in Blower Systems

The origin of a number of fires which have occurred from time to time in blower systems has never been definitely determined. In many such cases the evidence indicates that no common source of ignition (thermal) such as a flame is present and that the materials involved were not subject to spontaneous heating. The question has, therefore, been raised as to whether or not static electricity may be a source of ignition in blower systems.

To obtain data relative to this problem, tests were conducted by Underwriters' Laboratories, Inc., extending the work of earlier investigators by measuring the magnitude of static charges developed under conditions ordinarily occurring in blower systems.

Sheet-metal, Transite and wooden ducts of various sizes and lengths, some lined and some unlined, were employed in these tests.

From these tests it appears that air practically free from solid or liquid particles is not perceptibly electrified under conditions ordinarily obtaining in blower systems. If dust or lint is present in appreciable amounts, static charges of a magnitude capable of causing ignition by spark discharges may be generated. Voltages actually observed ranged from 100 to 10,000. It was observed that within certain limits the static charge increased in magnitude with increase in the concentration of dust or lint, fineness of particles, velocity of air stream, and decrease in humidity.

Data obtained in the tests involving projection of a spray into the air stream, from a practical point of view were largely negative.

[*"Generation of Static Electricity in Blower Systems." Bulletin of Research, No. 8, April 1939. Published by the Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill. Paper cover; 6 x 9 in.; 15 pages.*]

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H.P. and A.C.C.N.A. Engineering Standards

This is the third edition of the Engineering Standards of the Heating, Piping and Air Conditioning Contractors National Association. These standards have been considerably revised and enlarged and as before, they are published in the form of loose-leaf sheets and are furnished complete in a stiff covered loose-leaf binder.

The standards are divided into five parts entitled as follows: Figuring Radiation; Net Square Feet Radiation Loads in 70F Recommended for Low Pressure Heating Boilers; Pipe Sizes; Standard Dimensions of Valves, Fittings and Materials; and Air Conditioning.

[*"Heating, Piping and Air Conditioning Contractors National Association Engineering Standards"—third edition prepared by the Committee on Standards of the Heating, Piping and Air Conditioning Contractors National Association, 1250 Sixth Ave., New York. Loose-leaf binding; 8½ x 11 in.; 140 pages; price, $5. Distributed through local contractors associations.*]

Refrigeration Service Engineers Year Book

This is the second year the Refrigeration Service Engineers Society has issued a year book. The purpose of this book is to present information for use of its members and included is a directory of the Society's chapters, a list of the members, technical articles, tables of data and a chart of drawing symbols.

The subjects covered by the articles include pressure drop in suction lines, dryers and drying agents, heat, balancing cooling coils for condensing units, requirements of refrigerating oils and accident prevention and first aid in refrigeration service. The tabular section presents data on refrigerant and oil requirements of various condensing units; properties of ammonia, Freon, methyl chloride, sulphur dioxide and Carrene No. 1; thermostat settings; pressure control settings; temperature conversions and altitude corrections and gage readings.

[*"R.S.E.S. Second Annual Year Book." Published by the Refrigeration Service Engineers Society, 433 N. Waller Ave., Chicago, Ill. Heavy paper cover; 6 x 9 in.; 96 pages; price, $1.50 to non-members.*]

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Air Pollution

To obtain information on noxious gas pollution in Chicago due to the combustion of sulphur in coal, in January, 1937 the Chemical Engineering Division of the Engineering Experiment Station at the University of Illinois, in cooperation with the Smoke Inspection and Abatement Department of Chicago, undertook a preliminary survey of the sulphur dioxide concentration in the air over that city.

In making the survey the city was divided into seven districts according to the expected intensity capacity for the production of sulphur dioxide and the importance of the effects. The results obtained in the survey are presented in the form of tables and apparently justify the following conclusions:

(a) Approximately 50% of the sulphur dioxide pollution in the downtown business district originated in the district itself, or in sources located in the immediate vicinity.

(b) Residential districts in the north, northwest, and extreme south had the lowest concentrations of sulphur dioxide.

(c) Low chimneys, whether domestic or industrial, discharging gases resulting from the combustion of high sulphur fuels, contributed the major portion of the pollution.

[*"A Survey of Sulphur Dioxide Pollution in Chicago and Vicinity," by A. D. Singh. University of Illinois Bulletin No. 37, published by the University of Illinois, Urbana, Ill. Paper cover; 6 x 9 in.; 32 pages. Copies obtainable without charge until September 15, 1939 or until free supply is exhausted; after that the price will be 40 cents.*]

BRIEF REVIEWS

REFRIGERANTS. A revised and enlarged edition of this well known book on sulphur dioxide and methyl chloride refrigerants. The major part of the book consists of sections giving information on physical properties of these two refrigerants, including tables and charts giving the properties of the saturated vapor of both refrigerants. Other information included consists of the following: lubrication of sulphur dioxide and methyl chloride machines; comparative properties of various refrigerants; I.C.C. regulations for freight and express shipments of sulphur dioxide and methyl chloride; use of refrigerant tables; handling and transferring refrigerants; charging refrigerating systems; determining quantity of refrigerant for complete charge; pressure drop in suction lines; food storage data; viscosity data; and definitions as applied to refrigeration or air conditioning. [*"Ansul Refrigerants," 2nd Edition. Published by the Ansul Chemical Co., Marinette, Wis. Heavy paper cover; 8½ x 11 in.; 68 pages; price, $1.*]

REFRIGERATING STANDARDS. Standards supplementing the equipment standards published in 1938 by the Refrigerating Machinery Association. A list of the subjects covered includes base specifications for self-contained ammonia units; ammonia brine cooler ratings showing basic heat transfer curve as a function of brine velocity, mean temperature difference, brine temperature and brine concentration; Freon-12 mains showing tonnage allowances for various line sizes and operating conditions in Freon-12 suction and discharge and liquid lines; and standard nomenclature for reciprocating compressors. [*"Equipment Standards Supplement 'A'." Published by the Refrigerating Machinery Association, Southern Bldg., Washington, D. C. Paper cover; 8½ x 11 in.; 14 pages; price, 25 cents.*]

AIR CONDITIONING. A small booklet which tells the story of air conditioning in an entertaining manner. Booklet is illustrated in the Disney cartoon style and has been prepared to simplify the subject for the layman. [*"The Story of Air Conditioning." Published by the Bureau of Information, Air Conditioning Manufacturers' Association, Southern Bldg., Washington, D. C. Paper cover; 9 x 6 in.; 16 pages. Copies available from the Air Conditioning Manufacturers' Association.*]

CONDENSERS. A second edition of the Standards of Heat Exchange Institute covering condenser standards. Includes information on nomenclature; definitions and illustrations; condenser performance; materials of construction, atmospheric relief valve sizes; air pump capacity; tubing characteristics; air-water vapor mixture data; pressure temperature conversion tables; logarithms base E. [*"Standards of Heat Exchange Institute." Condenser section Part 1, Surface Condenser Standards; Part 2, Barometric and Low Level Jet Condenser Standards. Published by the Heat Exchange Institute, 90 West St., New York. Heavy paper cover; 8½ x 11 in.; 38 pages; punched for loose-leaf. Price, $1.*]

ESTIMATING. A general book on building estimating. Instructions in the text are built around an actual set of architectural plans for a small residence. In order that the estimator may have a clear picture of construction details, these items have been explained thoroughly for the various trades. The estimator is then shown the work involved in making an actual quantity survey and an actual labor estimate. The question and answer method is used through the text and typical questions relating to labor cost are asked and the answers given. Items comprising a typical estimate are presented in each of the survey estimating forms and these forms are part of the complete estimate. [*"How to Estimate for the Building Trades," by G. Townsend, J. R. Dalzell and J. McKinney. Published by the American Technical Society, Chicago, Ill. Cloth cover; 6 x 9 in.; 629 pages; price, $4.75.*]

EXHAUST VENTILATION. Description of the method employed in the Vermont granite industry for protecting workers from silicosis and associated lung diseases. The report states that medical studies indicate that 10 million particles per cubic foot of air can be recorded as a safe upper limit of dustiness and that engineering work shows that this limit can be obtained. [*"Ventilation in the Granite Industry," by Edward C. J. Urban in the Journal of Industrial Hygiene and Toxicology. Published by the Williams & Wilkins Co., Mount Royal and Guilford Aves., Baltimore, Md. March, 1939, pages 57 to 66. Price for single copies, 75 cents.*]

DEHUMIDIFICATION. A discussion of the use of calcium chloride for air conditioning including a description of Calorider equipment, performance in a test residence, commercial installations, production of Caloride, regenerative Calorider, and fields of application. [*"Air Conditioning," by C. R. Downs and J. W. Spiselman, published in the June, 1939, edition of "Industrial and Engineering Chemistry." Room 706, Mills Building, Washington, D. C. Pages 681 to 698.*]

BOILER WATER. A description of experiments on foaming of boiler water conducted with two widely different experimental boilers equipped with sight glasses to give a view of the interior. [*"Foaming of Boiler Water," by C. W. Foulk and John W. Ryznar. Published in Industrial & Engineering Chemistry, Room 706, Mills Building, Washington, D. C. Pages 722 to 725.*]

COAL ANALYSES. The twentieth of a series on coal analyses. Gives analytical data showing the composition and quality of the coals of Pennsylvania, description of the geologic structure of the coal basins, typical mining conditions in the different districts, and principal economic data of the industry. Presents salient facts regarding the occurrence, reserves, quality, characteristics, production, and uses of the coals of the State. [*"Analyses of Pennsylvania Bituminous Coals," by G. H. Ashley, A. L. Toenges, R. L. Anderson, W. E. Rice, C. M. Stull, N. H. Snyder, R. J. Swingle, H. M. Cooper, and R. F. Abernathey. Published by the Bureau of Mines. Technical paper 590. Paper cover; 503 pages; price, 50 cents; for sale by the Superintendent of Documents, Washington, D. C.*]

NEWS OF THE MONTH

Heating & Piping Contractors Celebrate 50th Anniversary; Hear Air Conditioning, Welding and House Heating Reports

CHICAGO—The golden anniversary of the Heating, Piping & Air Conditioning Contractors National Association was celebrated at the 50th convention of that organization held here May 30-June 2. It was fitting that the celebration was held in this city for it was here that, early in 1889, prominent members of the Master Fitters Association of this city called a meeting for discussing the need and necessity for a national central bureau to handle problems of steam-fitting contractors. The result of this meeting was the incorporation under the Illinois State laws, on April 12, 1889, of the Master Steam and Hot Water Fitters Association of the United States. The original incorporators were L. H. Prentice, F. W. Lamb and C. H. Simmons.

New officers were elected by the 50th convention to serve during 1939 as follows: president, W. J. Olvany of New York; vice-president, J. E. McNevin of Denver, Colorado; treasurer, S. Austin Pope of Chicago.

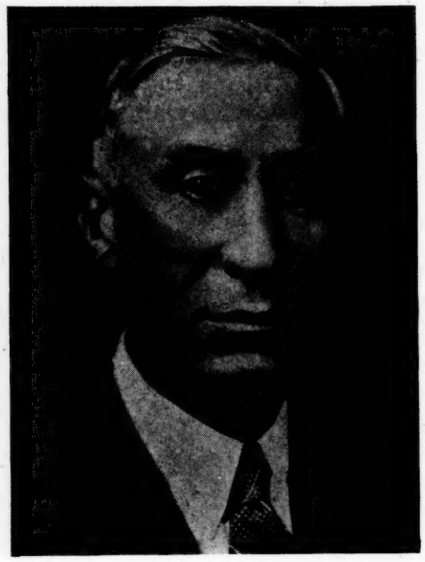
The following members were elected to the board of directors: W. H. Driscoll, A. F. Nass, Thomas O'Callaghan, G. J. Stoehr, Daniel Hayes, L. F. Hudepohl, G. P. Nachman and Mr. Pope.

In the report of the committee on air conditioning, J. L. DeNeille, chairman, the committee took as its basic premise the proposition that the contractor is the logical final outlet for comfort producing air conditioning apparatus. In its report, the committee stated that it does not believe that the unit air conditioner is the solution to all of the installation problems connected with air conditioning. However, the committee pointed out, it believes that the unit air conditioner has a place, but that contractors are more interested in the economies which might result from the use of remote compressor installation.

An outline of a simple and practical procedure on oxy-acetylene welding was stressed to the members by the committee on welding, of which T. I. Magan is chairman. The committee urged members to begin training apprentices in order to insure the success of welding in the future.

Last year the association adopted national standards for steam fitting apprentices. This was followed at the Chicago convention by a report of the committee on apprenticeship which listed a tentative course of study for apprentice schools which qualify for Federal aid. The course sets up a minimum of 144 hours of school attendance per year for five years.

The committee on boiler out-put, of which H. M. Hart is chairman, told the members that there is an increased interest in standardization of boiler selection by all branches in the industry, from the manufacturer to consumer. This committee stated that its principal complaint was the improper design of combustion chamber for stoker and oil burner application.



William J. Olvany, new president of the Heating, Piping & Air Conditioning Contractors National Association.

G. P. Nachman, chairman of the committee on standards, reported that his committee is working on the proposed revision of the safety code for refrigerating and air conditioning systems. This work is being carried on by the American Standards Association in conjunction with other interested groups. The committee is also working on the subject of refrigeration compressor and hopes that this information can be presented in a manner somewhat similar to the boiler output data.

As a part of the program of the committee on trade promotion a contest on small house heating was run by the association this spring and the winners of the contest were announced at the convention as follows:

First prize—A. E. Knible, L. L. McConachie Co.; *Second prize*—B. T. Bourne, Thomas Conlin Co.; A. W. Kelley, Orth & Kelley; *Third prize*—W. W. Hughes, Hughes Heating & Plumbing Co.; C. J. Crane of Elmer C. Lind, and F. R. Ellis of Buerkel & Co.

Another feature of the trade promotion committee program was the small house forum, which emphasized the necessity for cooperation between contractors and manufacturers if the problems of home radiator heating are to be solved.

Prevent Smoke Forming in Fuel Bed, Battelle Engineers Advise

MILWAUKEE—Furnaces and boilers are not meant to be smoke consumers, according to research engineers of Battelle Memorial Institute who addressed the Smoke Prevention Association meeting June 14 at the Hotel Schroeder here. The best way to keep chimneys free from smoke, they said, is to prevent smoke formation in the fuel bed, and underfeed stokers, because they are designed to do this, are essentially smokeless in operation. They also suggested that smoke ordinances of some cities are needlessly restrictive in demanding certain furnace volumes and often require useless expense to obtain them.

Several hundred fuel engineers, including smoke inspectors, technicians from government bureaus, universities and other institutions, representatives of the coal industry, and manufacturers of heating equipment heard the report of an extensive field study of stokers in actual operation. This was made last winter in Columbus, St. Louis, Cincinnati, and Chicago by research engineers of the institute.

The purpose of the survey was to find how freedom from smoke is related to size and height of the firebox, for which minimum figures are specified by some city ordinances. The survey engineers, R. C. Cross and H. N. Ostborg, employed specially designed portable test equipment in which a photoelectric cell gave an accurate continuous record of the smoke going up the stack. Flue-gas analyses and rates of coal feed were also determined on the job, and the supposedly critical combustion space and setting height were likewise measured.

Coal fired by stokers, according to the report, is likely to cause smoke only when manual attention is given to the fire or when the stoker shuts off, and no amount of combustion space could eliminate smoke caused in these ways. The elimination of the tendency for stokers to smoke when shutting down to await the renewed demand for heat was called a challenge to the ingenuity of the stoker manufacturer.

Ralph A. Sherman, supervising fuel engineer at Battelle and co-author with Messrs. Cross and Ostborg of the report, recommended further research, and said that many other factors than combustion space and setting height would have to be studied under controlled conditions. Among those which appear to be equally or more important are the adjustment of the air supply, the provision of excess air for shutdown periods, the effect of various types of coal, and the equally variable types of service for which stoker-fired heating plants are installed.

Installation Standards Emphasized at Warm Air Heating Convention; Year's Research Reviewed; 350 Attend

CHICAGO—Over 350 attended the mid-year meeting of the National Warm Air Heating and Air Conditioning Association held at the Hotel Stevens here June 7-9. Emphasis throughout the program was upon improvement in methods and the development of higher standards in design, manufacture and installation of heating and air conditioning equipment. This keynote, brought out strongly in President L. R. Taylor's opening address, and in the report of F. G. Sedgwick, chairman of the research advisory committee, was high-lighted by the announcement that the association is cooperating with FHA in the preparation of a standard code covering heating and air conditioning equipment for homes covered by FHA loans, for use of FHA inspectors.

Both the addresses at the meeting, and the discussion among members, revealed a strong determination to promote high standards of performance.

Mr. Taylor, in opening the sessions, made an appeal for further strengthening the membership of the association, and asked all the present members to support the work of the membership committee by recommending qualified firms to them. He pointed out that there are many manufacturers of accessory equipment or materials who benefit greatly by the activities of the association, particularly its cooperative research programs, publicity and development and maintenance of the standard codes, and who should be members.

K. C. Richmond, editor of *Coal Heat*, presented a review of the market situation in the heating and air conditioning field, illustrated by numerous statistical tables and charts, from which he drew the conclusion that only courage, foresight and intelligent planning is needed to assure an immense volume of profitable business in modern heating equipment and accessories.

Professors A. P. Kratz and S. Konzo, University of Illinois, presented reports on the year's work at the association's "research residence" at the University. Its most important feature was the thorough investigation of stoker operation in connection with a forced warm air heating system. This research, Professor Konzo made clear, has established definitely that stoker operation is entirely practical and economical with forced warm air heating, and has also developed a considerable amount of valuable data on the best operating practice for economy and over-all efficiency of the heating system.

Perl S. Miller of Columbus, made a report on "The Elimination of Waste in Our Industry Through Standardization" and B. F. McLouth of Lansing, Mich., spoke on "Our Installation Codes and Matters Pertaining to the Same."

Professor Lorin G. Miller, Michigan State College, reported regarding his studies of problems of rating and baffling forced warm air furnaces, aimed at clearing the ground for the development of codes and performance standards for the protection of the consumer. Other papers presented included: "Don't Oversell Clean Air Delivery," by Jan S. Irvine; "Cooling with Air Movement," by B. G. Krause; "Air Filtration In Connection with House Dust, Hay Fever and Pollen Asthma Allergy," by Dr. William H. Welker of the University of Illinois College of Medicine; "Two-Speed Blower Operation," by H. F. Curtis; and "How Best to Help the Dealer Sell," by William Cook.

261 Gas Heated Houses for N.Y.

NEW YORK — As a result of a new promotional house heating builders plan of the Consolidated Edison Company of New York, Inc., twenty-two builders have made commitments within the past week to install gas equipment for house heating and water heating in developments in the Bronx and Queens having a total of 261 homes ranging in price from $5,500 to $11,000.

This represents more sales made to builders than were made in the system's territory during the entire year of 1938. All told there are more than 11,000 installations of gas house heating and water heating equipment in homes on the lines of the Consolidated Edison Company and its affiliated companies.

New Chapter Forming in Oregon

PORTLAND, ORE.—Heating and ventilating engineers of this city are planning a new chapter of the ASHVE. Meetings have been held towards this purpose with leaders in the profession taking an active part.

Randall Elected by Detroit Group

DETROIT, MICH.—W. C. Randall was unanimously elected president of the Michigan chapter, ASHVE, at the annual meeting of the chapter May 23. Other officers, also unanimously elected to serve during the 1939-40 season, are: vice president, G. H. Tuttle; secretary, W. H. Old; treasurer, J. S. Kilner. M. B. Shea, S. S. Sanford and J. S. O'Gorman, Jr., were elected to the board of governors.

Stoker Operating School Held by St. Louis Group

ST. LOUIS—A school on stoker operation was conducted by the St. Louis Stoker Association here during May. The purpose was to instruct janitors and operating men in stoker operation in order to assist them in operating stoker and boilers and also to enable stoker manufacturers to profit through questions asked by their janitors.

The school was the result of a suggestion by Raymond Tucker, commissioner of smoke regulation of the city, to Louis Maginn of a prominent realty firm, who was interested in obtaining information on stokers for janitors employed in his firm. They found a number of firms interested, so that the school was begun for a limited number of men. It is expected that this will be a forerunner of a larger school to be conducted next fall.

The staff of instructors includes G. A. Hale, consulting engineer and executive secretary of the association; John Dryden, mechanical engineer of Link Belt Co., and J. A. Hansen, mechanical superintendent, of the Iron Fireman Co. of St. Louis.

Included in the course were talks on The Purpose of the Course, A Short Story of Coal, The Story of Fire, The Three Atoms, Story of Boilers, a talk on Boilers, the Story of Stokers, Controls, and Smoke Regulations.

The school was named the Clinker Puller's Institute and is graduating men with the degree of Master Clinker Pullers.

The staff of instructors at the St. Louis stoker school. Left to right: G. A. Hale, John Dryden, and G. H. Hansen.

FHA Act Amended; Home Building Activity to Continue, Administrator Stewart McDonald Predicts

WASHINGTON — The President's signature of the National Housing Act Amendments of 1939 should assure a continuation of home construction activities during coming weeks at a pace well ahead of last year, FHA Administrator Stewart McDonald said June 10.

So far this year, Mr. McDonald said, the home financing activities of the FHA have shown a substantial increase over the corresponding period of 1938. For example, mortgages selected for appraisal during the first five months of this year totaled $500 million, an increase of 40% over the $358 million selected during the same months of 1938. Mortgages accepted for insurance during the first five months of 1939 totaled $285 million, a gain of 48% over the same period of 1938.

Mr. McDonald expressed the opinion that it was safe to predict a sustained volume of applications for insurance of small home mortgages and modernization loans during the coming weeks, especially since final enactment and Presidential signature of Amendments extending certain FHA functions due to expire June 30 under the old law should remove any doubt as to the continued availability of the most liberal financing facilities in the nation's history.

Principal features of the amended Act are:

(1) Authorization for the President to increase to $4 billion the amount of outstanding mortgage insurance obligations the FHA may have at one time. The present limitation is $3 billion, and the outstanding principal obligation at this time is approximately $1.4 billion, not including approximately $400 million in outstanding commitments to insure.

(2) Continuation of the FHA's authority to insure mortgages on existing construction until July 1, 1941.

(3) Requirement that in the refinancing of mortgages the applicant for insurance must file a certificate that the mortgage holder has refused to grant him equally favorable terms.

(4) Extension indefinitely of the authority of the FHA to insure mortgages on small homes involving mortgages of not more than $5,400 for terms up to 25 years.

(5) Authorization to continue insurance of lending institutions against loss on property improvement loans up to $2,500 each with a new provision empowering the Administrator to charge an insurance premium not in excess of three-fourths of one percent to off-set a portion of operating expenses and losses.

(6) Establishment of a prevailing wage scale to be determined by the Secretary of Labor on large-scale projects.

(7) Revision of the conditions under which insurance may be granted on mortgages covering large-scale projects.

(8) Repeal of Section 210 under which the Administrator was authorized to insure mortgages under special conditions in the price range up to $200,000.

'37 Oil Sales for Heating Up 18%

WASHINGTON — Approximately 116,583,000 barrels of fuel oil were used for the heating of buildings in 1937. This quantity was 26% of the domestic sales of fuel oil for all purposes. Deliveries of fuel oil for building-heating during 1937 were 18% over the 1936 total, while 1936 was 29% over 1935.

The lower rate of increase in heating oil consumption in 1937 was partly due to adverse business conditions in the latter part of the year and also to mild weather, according to the statistical and economic surveys division of the Bureau of Mines.

H.&V. Exposition Committee Forms; Space Two Thirds Sold

NEW YORK—More than two-thirds of the total exhibit space for the Sixth International Heating and Ventilating Exposition is reported as taken by exhibitors. The exposition will be held in Lakeside Hall, Cleveland, January 22-26.

The exposition is held under the auspices of the ASHVE in conjunction with its annual meeting. The National Warm Air Heating and Air Conditioning Association will hold their national meeting at Cleveland during the same week, as will other organizations.

The advisory committee of the exposition, composed of leaders in the industrial fields represented, has just been announced. J. F. McIntire, president of the ASHVE is chairman of the committee. Other members are: Dr. F. E. Giesecke, W. L. Fleisher, E. H. Gurney, M. F. Blankin, J. H. Walker, Prof. G. L. Tuve, John Paul Jones, L. T. Avery, R. M. Conner, O. W. Motz, Frank H. Dewey, J. M. Frank, William B. Henderson, W. C. Murray, Gardner Poole, Ole Singstad, Wallace J. Snow, Ernest Szekely, and L. R. Taylor.

Battelle Institute Adds Economist

COLUMBUS, OHIO—George R. Kinzie, economist and business analyst, has been added to the staff of Battelle Memorial Institute, Columbus, Ohio, in order to aid in the consideration of economic factors related to the problems of industrial research.

A.C.M.A. Elects Danley President

WASHINGTON, D. C. — P. Y. Danley, Westinghouse Electric & Manufacturing Company, Springfield, Mass., was elected president of the Air Conditioning Manufacturers' Association at the recent annual meeting in Hot Springs, Va. Other officers are S. E. Lauer, York Ice Machinery Corporation, York, Pa., vice president; P. A. McKittrick, Parks-Cramer Company, Fitchburg, Mass., treasurer; and W. B. Henderson, Washington, D. C., executive vice president.

P. Y. Danley

The new president, Philip Yale Danley, is manager of the air conditioning department of the Westinghouse Electric and Manufacturing Company.

Harry J. Ryan

ALBANY, N. Y.—Harry J. Ryan, manager of The Trane Company branch office here, died suddenly at his home on June 13. According to his associates they had left him in apparent good health the previous evening.

In years of service, Mr. Ryan was the dean of The Trane Company branch office managers, having joined the organization in 1921 at which time he established the Albany office in which position he served continuously until his death.

Mr. Ryan was a licensed engineer in the State of New York and a member of the American Society of Heating and Ventilating Engineers.

Robert E. Keyes

PHILADELPHIA, PA.—Robert E. Keyes 54, chief engineer of the Cooling and Air Conditioning Division of the B. F. Sturtevant Co., died at the Metropolitan Hospital here May 29, of pneumonia. Mr. Keyes, a graduate of the Massachusetts Institute of Technology, was first employed by B. F. Sturtevant in 1909 and, except for three short intervals, was active in that company's interests since that time, particularly in the development of air conditioning. Mr. Keyes made a fundamental contribution to the air conditioning industry in his development of the method of by-passing re-circulated air from the conditioned area around the conditioner and then mixing the two air streams, all under automatic control. He also developed and patented other systems, methods and devices in connection with air conditioning.

WITH THE MANUFACTURERS

Stoker Manufacturers Association Meets, Re-elects Sammons; Considers National Advertising Campaign

CHICAGO — Practical means of expanding the sales of automatic coal stokers were discussed in detail at the meeting of the Stoker Manufacturers Association held at French Lick Springs, Ind., June 1-2. Reports on activities of the association were made by chairmen of the various committees on research, advertising, legislative, engineering, commercial, membership, and executive.

At the opening session President E. C. Sammons reported on the progress of the stoker industry in general. Mr. Sammons stated that the association had made considerable progress during the past year and that it would continue its aggressive and constructive efforts on behalf of the entire stoker industry to promote the wide spread use of automatic coal burners for both bituminous and anthracite coal.

At the general session on June 2, to which coal operators, accessory manufacturers, railroad men, and others in allied industries had been invited, speakers of national prominence gave addresses on various phases of business of direct interest to both stoker manufacturers and allied organizations.

Julius K. Luthe, president, Perfex Corporation, said that the market for automatic home and building heating equipment with all types of fuel is "very much under-sold." He said that builders of new homes are beginning to show a marked preference for complete heating units. Mr. Luthe covered the progress in the control manufacturing business during the past few years and stated that the rapidly growing trend in the stoker industry is for the manufacturer to sell his stoker only as a complete appliance equipped with controls and other accessories, using his own individual name.

H. J. Spear, assistant general sales manager of Koppers Coal Company, Pittsburgh, stated that the producers of smokeless stoker coal had benefited definitely from the growth of the automatic heating stoker sales in the past several years. He made a number of suggestions for furthering cooperation between the stoker and coal industries.

Industrial research and promotion are "insurance capital", Clyde E. Williams, director of Battelle Memorial Institute, told those assembled. He said that stoker manufacturers, in order to maintain their position and to make as much progress in the future as in the past, must invest in research and experimental promotion work. He said that all industries pass through two stages—one of development of technical features and method of marketing; and the second of active sales, which should be a period of stability and profits.

Consideration was given by the executives of the association to a national advertising and public relations program which has been prepared in great detail by the advertising committee and Secretary Bluth. Final action was deferred till October.

At the closing session of the convention a number of resolutions were passed and a strong stand was taken against Federal taxation and spending in the following resolution:

"This association is opposed to the continued program of our national government attempting to spend us back to prosperity, resulting in a mounting burden of taxation with its ultimate reflection in the cost of merchandise which we sell."

The meeting concluded with the annual banquet, which was addressed by Barton R. Gebhart of Chicago, vice-president of the Chicago, Wilmington & Franklin Coal Company. Mr. Gebhart reviewed the past ten-year history of the stoker industry and stated, "You have dotted the country with stoker manufacturing plants, creating new employment and payrolls. You have successfully tackled the American mass market. You have brought the most revolutionary change in domestic heating in the history of solid fuel and you've shaken the coal industry out of a long nightmare and forced changes in coal preparation so radical they were not dreamed of ten years ago. The coal industry is your partner. The stoker equipped plant gives coal a much more stable outlet than the hand-fired plant and an outlet that can be served with economy to the user and profit to the producer and retailer of coal.

E. C. Sammons, vice-president, Iron Fireman Manufacturing Company, was re-elected president of the Association for another year. Frank Hoke, vice-president, Holcomb & Hoke Manufacturing Company, was re-elected vice-president; and G. Walter Ostrand, Link-Belt Company, was re-elected treasurer. Marc G. Bluth was re-appointed executive secretary.

Three new members were accepted into membership: Peerless Manufacturing Co., Louisville, Ky.; Conco-Sampsel Stoker Corp., Mendota, Ill.; and McDonnell-Miller, Chicago.

Delco Heat Returns to Rochester

ROCHESTER, N. Y.—The sale of all Delco heat products has again been placed under the management of the Delco Appliance Division, General Motors Sales Corporation, after having been handled through the Delco Frigidaire Conditioning Division at Dayton since 1936. The physical shift is now completed.

C. E. Lewis formerly sales manager for Delco-Frigidaire heads the new sales organization. Sales promotion and advertising is under O. E. Wolf who formerly occupied the same position with Delco-Frigidaire. George Johnson, for many years service manager for Delco Appliance Division will be service manager on Delco-heat. Engineering and product development is directed by W. H. Hutchins.

Torrington Fan Builds Laboratory

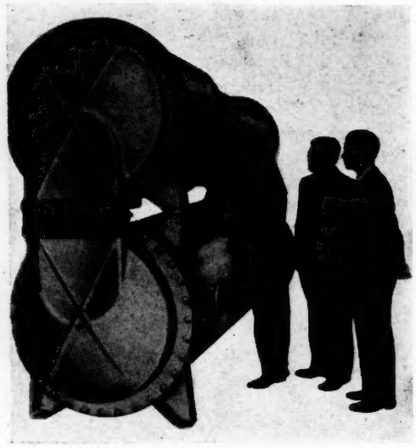
TORRINGTON, CONN.—The Torrington Mfg. Co., has recently built a new laboratory, part of which is shown in the accompanying illustration, for the development and testing of propeller fans and blower wheels. The laboratory measures approximately 30x100 ft.

Facilities are available for free air testing, according to the NEMA code, and for pressure and exhaust testing of propeller fans up to 30 in. in diameter and blower wheels up to 20 in. diameter. Facilities are also available for endurance tests and for testing fans for appliances, such as unit heaters and unit coolers, oil burners and similar equipment. Attic fans up to 48-in. diameter can be tested.

(Concluded on page 83)

Part of the new development and testing laboratory of the Torrington Mfg. Co., Torrington, Conn.

NEW EQUIPMENT

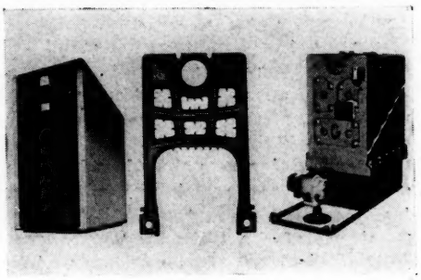


Trane Air Conditioning Water Cooler

NAME—Trane Turbovac.
PURPOSE—A self-contained unit for cooling water for air conditioning purposes.
FEATURES—Turbovac is a hermetically sealed low pressure water chiller. It consists of a compressor of the centrifugal type, a water cooling unit and a condenser all housed within a steel casing in one compact unit. Refrigerant employed is of the Freon family and has a boiling point of 120F at atmospheric pressure. Compressor is powered by two motors which make it possible to cut in one motor at a time, thereby reducing the load on the line and making starting easier. The two motor rotors are the only moving parts. Motors are especially manufactured and are oiled from the outside of the unit when in operation. Impellers are fabricated entirely of nonferrous metal to prevent corrosion and subsequent unbalance. They are given a thorough static and dynamic balance with the motor on which they are mounted. There are two coils of the fin and tube type, one used to chill the water and the other used to condense the refrigerant. Coils are constructed entirely of red brass and are suitable for pressures as high as 250 lbs. per sq. in. Shells are electrically welded of heavy steel plates and all joints are sealed with neoprene gasket material. Turbovac is shipped knocked down in two parts which are said to be easily assembled on the job. Installation requires only water and electrical connections.
SIZES AND CAPACITIES — At present available in one size only, with capacity range from 65 to 80 tons of refrigeration. This unit is approximately 11½ feet long, 8 feet high and 4 feet wide and weighs slightly more than 12,000 lbs. Units of 100, 150 and 200 ton capacity will soon be added.
MADE BY—*Trane Company, La Crosse, Wisc.* *1*

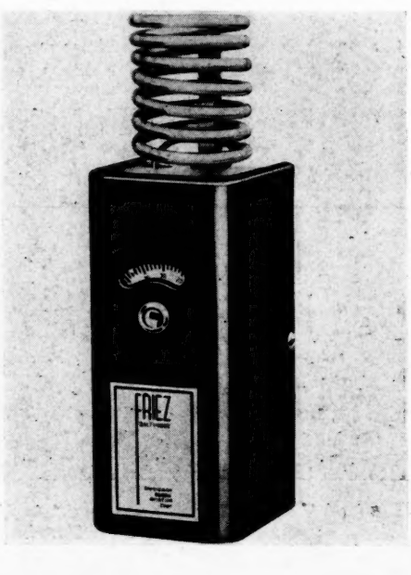
Utica Oil Burning Boiler

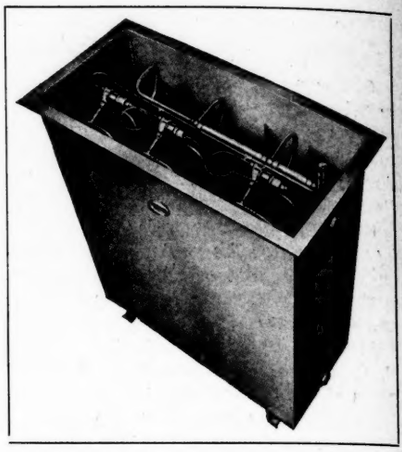
NAME AND MODEL NUMBER—Utica oil burning boiler, Series OB.
PURPOSE—For supplying steam or hot water utilizing oil as a fuel.
FEATURES—Boiler sections have finned surfaces. Controls are accessible for making electrical connections with the oil burner and the jacket is of the latest design and is so constructed that it is raised above the floor for easy cleaning and for protection from rusting at the edges where it customarily touches the floor.
MADE BY—*Utica Radiator Corp., Utica, N. Y.*.....*2*



Friez Space Thermostats

NAME—Friez "hydraulic action" self-contained space thermostats.
PURPOSE—For the control of temperature in all domestic and commercial comfort cooling installations.
FEATURES — This line of controls features the hydraulic action principle of operation. It is said that the exposure of the coiled element on top of the case assures great sensitivity. This line of thermostats has a heavy load carrying capacity without the need of relays (25 amperes at 120 volts, 15 amperes at 240 volts.)
MADE BY—*Julien P. Friez & Sons. Baltimore, Md.* *3*



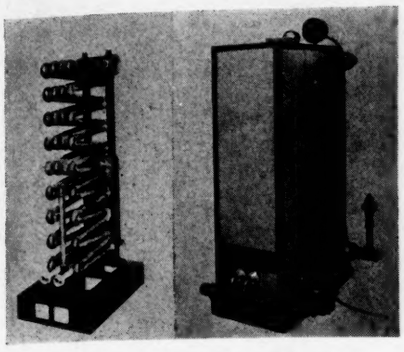


McQuay Cold Accumulator

NAME—McQuay Cold Accumulator.
PURPOSE—Storing cooling effect.
FEATURES — The cold accumulator consists of the specially designed tank containing copper plate coils, upon which a thin coating of ice is formed. The accumulators are designed for either Freon or methyl chloride refrigerants and make possible the use of small condensing units to meet heavy cooling loads of short duration. In operation the condensing unit operates over long periods to build up ice in the accumulator. When there is a demand for refrigeration the refrigerating effect stored in the ice is utilized. The cold accumulator is built of heavy copper plates to which copper tube primary surface is attached and groups of these plates, spaced properly, form a section. One thermal expansion valve is used for each section. The McQuay velocity header is used to furnish the correct amount of refrigerant to each plate. The plates are staggered in each assembly so as to provide alternate dams causing water to flow up and down from 5 to 43 times, depending upon the unit. The control of the thickness of the ice is automatic.
SIZES—Accumulators are built with capacities up to 1,000,000 B.t.u.
MADE BY—*McQuay, Inc., Minneapolis, Minn.* *4*

Pioneer Tank Heater Control

NAME — Pioneer tank heater control.
PURPOSE — For controlling temperature of water heated by solid fuel-fired water heaters.
FEATURES — Device consists of a thermostat and a flue pipe damper. The thermostat is attached either to boiler or hot water return pipe and causes the damper to open or close to maintain the proper temperature.
MADE BY—*The Pioneer Regulator Division of The Master Electric Co., Dayton, Ohio.* *5*

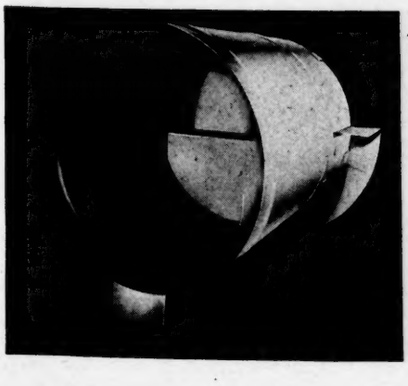


Halloran Gas-Fired Boiler

NAME—Coprtube gas-fired boiler.
PURPOSE—For supplying hot water using natural or manufactured gas as a fuel.
FEATURES—Boiler is made up of hard drawn copper tubing, cast bronze U-bends and steel box headers all brazed together to form a unit, also burners and sheet metal casing. Boilers are made in seven models with from two to eight burners and all models use the same tubing assembly, differing only in the number of burners and tubing assemblies. The gas manifold assemblies and controls as shown on the two-burner model (see illustration) are standard on all models except that the gas burner manifold is larger in diameter to carry larger controls and is lengthened to accommodate additional burner valves. Boiler is equipped with motorized gas valve, pilot assembly, immersion water temperature control, gas pressure regulator, water relief valve, shut-off valve and altitude and thermometer gage. It is approved by the American Gas Association for both manufactured and natural gas.
SIZES AND CAPACITIES — Seven models from two to eight burners rated at 75,000 B.t.u. input per burner and 400 sq. ft. hot water EDR per burner.
MADE BY—*The Halloran Co., Memphis, Tenn.* 6

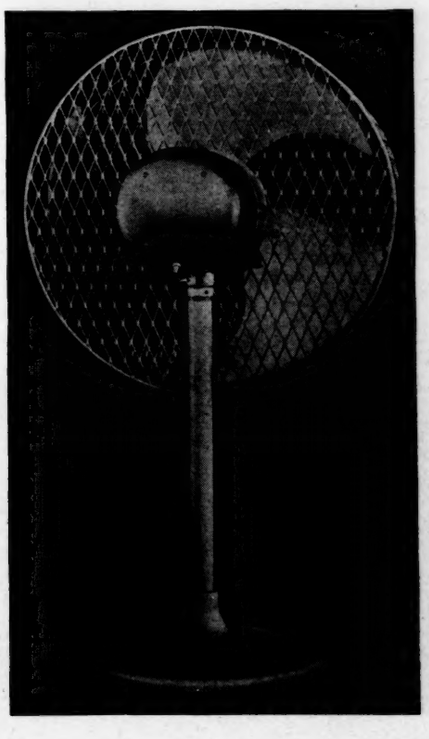
Titusville Combustion Chamber

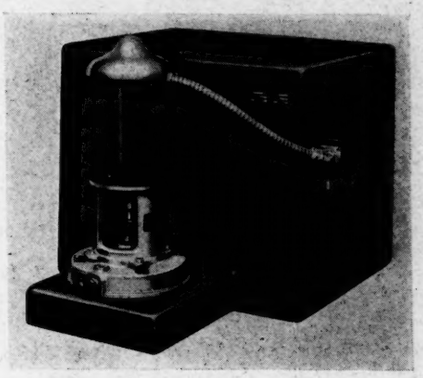
NAME—Ti-Glow oil combustion chamber.
PURPOSE—A permanent type combustion chamber designed to bring the furnace temperature instantly to the point where complete combustion takes place and at the same time retard the exit of hot gases until they have given up the greater part of their heat.
FEATURES—This combustion chamber is made of a chrome alloy which is said to resist corrosion and the effects of high temperature. The manufacturer states that the use of such a furnace lining will increase combustion efficiency. It is also said that the time for labor of installation, testing, maintenance of brick combustion chambers will be eliminated.
MADE BY—*The Titusville Iron Works Co., Titusville, Pa.*.....7



Ilg Attic Fans

NAME—Ilgwind fans.
PURPOSE—For attic cooling and ventilating of residential buildings.
FEATURES — The regular type Ilgwind fan is designed to be mounted on an adjustable pedestal and placed in front of an open attic or hall window. The Southern type Ilgwind consists of a fan mounted on a short stem and housed in a special or locally built suction box for use in attics when the construction is very open and fan must draw directly from the floor below. Box is available complete with grille. An automatic fire switch is available where state or local laws require it.
CAPACITIES — From 3080 to 7600 c.f.m.
LITERATURE AVAILABLE—Bulletin 609.
MADE BY — *Ilg Electric Ventilating Co., Chicago, Ill.*.....8



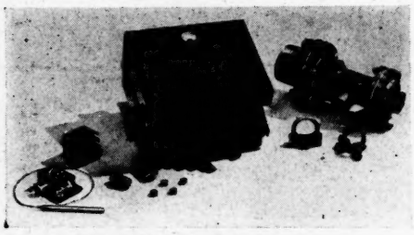


Sterling Condensation Pumps

NAME AND MODEL NUMBER — Sterico 3900 Series condensation pumps.
PURPOSE — For the pressure return of condensate to boiler.
FEATURES — Cast iron receiving tank; high efficiency bronze fitted centrifugal pump, large water handling capacity with smaller motors without overloading; ball bearing motor; positive seal float switch; cadmium plated float.
SIZES AND CAPACITIES—Manufactured in simplex and duplex types for capacities 6000 sq. ft. EDR to 40,000 sq. ft. EDR, pressures 10 lb. to 40 lb.
LITERATURE AVAILABLE—Bulletin 384-A.
MADE BY—*Sterling Engineering Co., Milwaukee, Wis.* 9

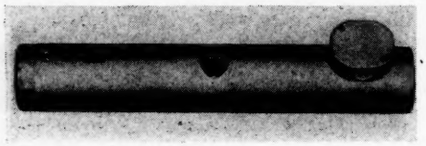
Mercoid Stoker Timer

NAME AND MODEL NUMBER—Mercoid Type THV Stok-A-Timer.
PURPOSE — For maintaining stoker fires during periods when the thermostat does not call for heat.
FEATURES—The distinguishing feature of this control is the heat motor which operates a gearless mechanism having one rotating member that turns at a rate of 1 r.p.h. Control requires no lubrication and has an electrical capacity of 10 amperes at 115 volts, 5 amperes at 230 volts.
MADE BY—*The Mercoid Corp., Chicago, Ill.* 10



Purdue Viscous Liquid Heater

NAME—Lines Thermal Electric Conduction System.
PURPOSE—For heating viscous liquids such as fuel oils.
FEATURES—The manufacturer states that this system of heating liquids utilizes a new principle which permits heating of the oil from a point inside of the tank to the point of use. Temperature is thermostatically controlled throughout the length of piping. Unit consists of a transformer, tank unit and thermostat. The transformer supplies electrical energy to make the entire pipe system from the tank to the burner a long heating unit. The oil is thus continually heated as it flows from the tank to the oil burner. Proper temperature is maintained by the thermostat. Unit requires a source of electric power with a voltage of 110, 220, 440 of 60 cycle, single or polyphase characteristics.
MADE BY—*Albert G. Purdue Associates, New Haven, Conn.....11*



Wheelco Electric Valves

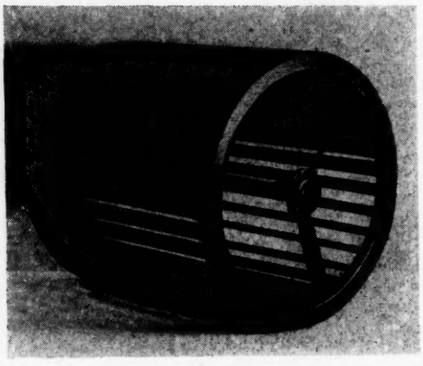
NAME AND MODEL NUMBER—Wheelco electric valves, Series 1223.
PURPOSE—A self-contained electric control valve for throttling of gas, oil or air flow.
FEATURES—Unit combines valve and operator in a totally enclosed casing. The electro-thermal expansion principle results in control without mechanical movement other than the expansion or contraction of the enclosed operating cylinder. It is said that once it is installed and adjusted the valve will operate for years. It is also said that the valve has a tapered response curve which minimizes hunting.
MADE BY—*Wheelco Instruments Co., Chicago, Ill. 12*

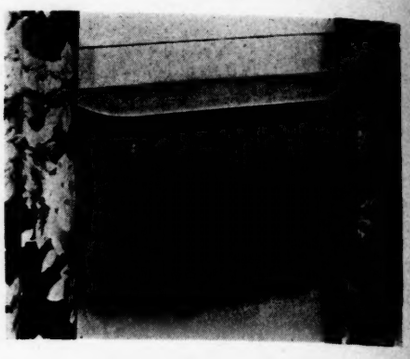
Penn Damper Control

NAME AND MODEL NUMBER—Draftender damper motor, Type 910.
PURPOSE—For opening and closing draft and check dampers on hand-fired heating furnaces.
FEATURES—Motor is a brushless shaded coil transformer type motor which provides electric operation in both directions from a simple two-wire pilot or thermostat control. It is designed to be used with the standard Penn Temptrol. In place of the conventional operating arm, this motor uses a cut sprocket gear which transmits the power to the dampers by means of a sprocket chain. Motor includes an external coil spring which gives positive spring return to the check-fire position in the event of current failure, the opening of a line switch or for any other cause. This motor is offered in standard package sets for all types of furnace and boiler installations. Sets include Penn Temtrol, limit switches, and wire, staples, pulleys, hooks, return spring and furnace chain.
MADE BY—*Penn Electric Switch Co., Goshen, Ind. 13*

Metal Stamping Blower Wheel

NAME—Blower wheel.
PURPOSE—A blower wheel for furnaces, air conditioning units, stokers and oil burners.
FEATURES—Blades are fabricated in one complete strip and assembled in the blower as an integral unit. It is said that this method of construction has resulted in a blower of greatly increased rigidity with a considerable reduction in weight. Rim, spokes and hub are made of one integral stamping to insure alignment and the rims are of channel shape for strength.
MADE BY—*The Metal Stamping & Mfg. Co., Cleveland, Ohio.....14*



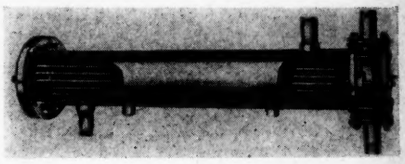


Airtemp Room Coolers

NAME—Cool Breeze.
PURPOSE—A window cooling unit.
FEATURES—Unit requires a window sill mounting and an electrical outlet. Condensing unit has a 1/3-hp. radial compressor which has its working parts finished with the new Superfinish process recently developed by Chrysler. It is said that in operation the room unit is much quieter than the ordinary electric fan.
MADE BY—*Airtemp Div., Chrysler Corp., Dayton, Ohio. 15*

Water Tube Boiler Oil Heater

NAME—Wa-Tu-Bo multipass straight tube oil heaters.
PURPOSE — For preheating fuel oils using steam or boiler water.
FEATURES—Heater consists of steel tubes expanded into steel tube sheets with the whole assembly welded in a steel shell. No internal gaskets or plugs are used and it is said that this



eliminates the possibility of leaks. The headers are removable so that access can be had for cleaning, inspection or replacement of tubes. Heater is designed to use live steam at full boiler pressure when a final temperature of over 200F is required or to use low pressure or exhaust steam where lower temperatures are desired. Where the temperature of the oil need not be over 180F, boiler water can be circulated through the shell of the heater. The manufacturer states that no pipe connections need be broken to clean the inside of the heater.
SIZES AND CAPACITIES—Standard sizes available for heating from 16 to 310 gal. of oil per hr. from 80F to 150F with 212F boiler water. With steam the oil can be heated 100F in quantities of from 16 to 1377 g.p.h. depending on steam pressure. Larger size heaters are available.
MADE BY — *Water Tube Boiler and Tank Co., Inc., Chicago, Ill.....16*

(Concluded on page 78)

THE ANEMO-LIGHT

The Anemo-light is a combination of the Anemostat High Velocity Air Diffuser and a Built-in Light. It has been designed to provide draftless, even, distribution of air—both heated and cooled—thereby equalizing temperature and numidity throughout the room, and to provide scientific lighting.

The section of the Anemo-light which serves as the air diffuser is of a design and dimensions different than the standard Anemostat. The largest member has a handsome fluted, polished edge. The beaded edges of the inner members are also polished. The complete fixture is of the recessed type, fitting tightly against the ceiling with a minimum projection below the ceiling line. It is spun of aluminum and sprayed with aluminum lacquer.

The Anemo-light is so constructed that, like the standard Anemostat, it will draftlessly diffuse any volume of air supplied to the device at any velocity, subject only to the limitations imposed by the noise created in the duct. At the different velocities recommended for rooms used for different purposes, the increase in decibel rating by the Anemo-light itself is negligible.

The lighting unit is a Holophane Reflector Refractor. Its sparkling, crystal, prismatic glass is pleasing in appearance—both when lighted and cold. When lighted a portion of the reflected light is thrown on to the flaring cones of the air distribution section of the device which gives a luminous quality and a feeling of lightness to the entire fixture accentuated by the polished edges.

Complete information available upon request

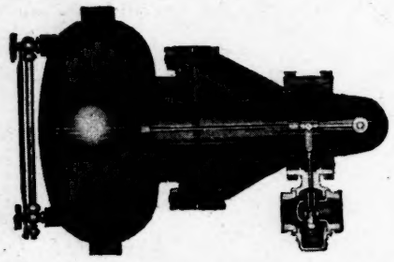
ANEMOSTAT CORPORATION OF AMERICA
10 EAST 39th STREET NEW YORK CITY

ANEMOSTAT

NO AIR CONDITIONING SYSTEM IS BETTER THAN ITS AIR DISTRIBUTION

AN-38

New Equipment



McAlear Feed Water Regulators

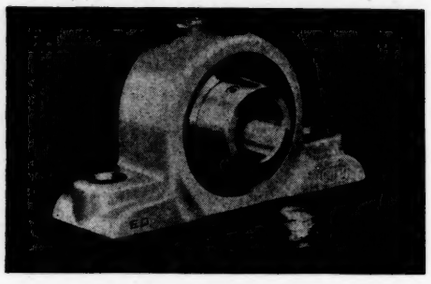
NAME AND MODEL NUMBER—Feed water regulators, 906, 907, 936, 966.
PURPOSE—To maintain constant safe water levels automatically in any steam boiler and to prevent damage by stopping firing equipment when boiler water reaches a dangerous level.
FEATURES—The boiler water level required for safety is reproduced exactly in the float chamber of the regulator and a drop in level causes the float-controlled independent feed valve to open to supply the necessary make-up water. Regulator No. 906 maintains proper levels in individual boilers supplied by steam pumps which are controlled by governors. For applications where electric motor-driven pumps are used, regulator No. 936 is recommended. It is equipped with a low water cut-out switch and is otherwise the same as 906. Regulator 966 is similar to 906 except that it is equipped with a combination low water cut-out and pressure switch. A motor-driven feed water pump may be controlled by the cut-out switch, while an automatic burner may be cut off by the pressure switch when the boiler pressure exceeds a predetermined point. Regulator No. 907 is used when it is desired to employ the feed valve to regulate the flow of steam to a steam-driven pump and thus maintain the proper level in the boiler. Regulator 907 is suitable only to applications in which boilers are supplied by individual pumps. All regulators are made of semi-steel with stainless steel float and trim for pressures up to 250 lb., and of cast steel with stainless float and trim for pressures of over 250 lb.
MADE BY—*The McAlear Mfg. Co., Chicago, Ill.* 17

Forker Cooling Fans

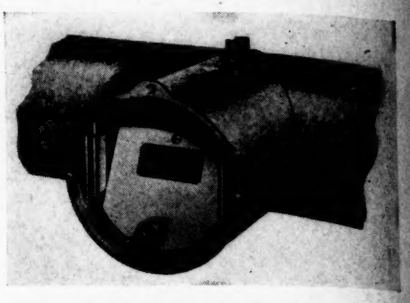
NAME—Apartment cooler, home cooler and house cooler.
PURPOSE—For circulating large amounts of air.
FEATURES—All fans have Airistocrat fan blades and are mounted on a panel board back which is made of five-ply fir, finished in natural grain. Three types of fans are furnished in sets complete with electrical cord, feed through switch, spring plug and two heavy brass hooks.
SIZES—Apartment cooler, 2500 c.f.m.; home cooler, 3500 c.f.m.; house cooler, 4500 c.f.m.
MADE BY—*The Forker Corp., Cleveland, Ohio.* 18

Ahlberg Ball Bearing Pillow Blocks

NAME AND MODEL NUMBER—Ball bearing pillow blocks, Series ED.
PURPOSE—To make anti-friction efficiency practical for many light machine applications where the cost of ball bearings has been prohibitive.



FEATURES—Pillow blocks consist of a specally designed Ahlberg single row bearing in a die-cast housing. The ball bearing is assembled to provide for shaft deflection and misalignment up to 1°. Seals are of a floating construction which are said to eliminate friction and increase the life of both seals and bearing. Seals are made of Neoprene, a long-wearing synthetic rubber, which is not affected by oil or grease. The manufacturer states that these low-cost units are especially adapted to air conditioning equipment.
SIZES—Standard shaft sizes are ½, ⅝, ¾, $1\frac{5}{16}$, 1, $1\frac{1}{8}$ and $1\frac{3}{16}$ in.
MADE BY—*Ahlberg Bearing Co., Chicago, Ill.* 19

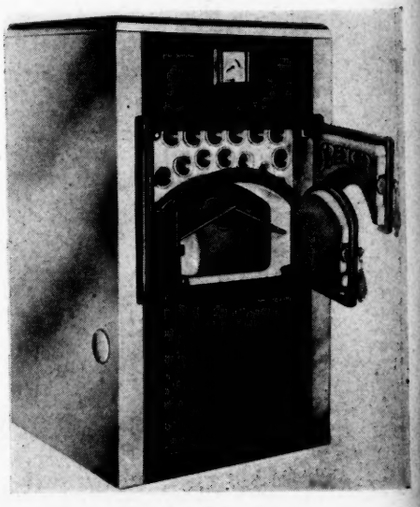


Conco Barometric Draft Control

NAME—Field draft control.
PURPOSE—For maintaining a constant draft on boilers and furnaces.
FEATURES—Control is made of heavy sheet metal and is equipped with side wings through which the gate moves closely. The gate itself is mounted off center to develop a greater effective area on which the draft can operate. The manufacturer states that a special axis mounting reduces friction and the need for oil. To lessen the possibility of the gate becoming warped or clogged with soot, the housing is extended to a point so that the gate does not swing into the flow of flue gases
SIZES AND CAPACITIES—Available in seven standard sizes, 6 to 20 in.
MADE BY—*Conco Engineering Works, Division of H. D. Conkey & Co., Mendota, Ill.* 20

Spencer Oil Boiler

NAME AND MODEL NUMBER—Spencer oil boilers, K-50 Series.
PURPOSE—For supplying steam or hot water using oil, gas or stoker-fired coal.
FEATURES—Boilers are constructed of steel and are of the fire tube type. They are supplied with an attractive casing and have the indicating instruments on a dial above the fire-door. Two models available rated at 400 and 500 sq. ft. EDR.
MADE BY—*Spencer Heater Division, Lycoming Mfg. Co., Williamsport, Pa.* 21



TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below circle the item number of the equipment in which you are interested, using the number found at the end of each item.

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	

(This service available only to engineers or executives)

Fill in your name and address, detach and mail to
HEATING & VENTILATING, 148 Lafayette St., New York, N. Y.

Name.....
Title.....
Firm.....
Business Address .....
City and State 7/39

THE WORLD'S LARGEST HOUSING PROJECT

Artist's conception of one section of Parkchester as it will look completed.

Partial view of a model living room in Parkchester showing the new Arco-Metro Convector installed under window.

AMERICAN HEATING EQUIPMENT COSTS NO MORE THAN OTHERS

USES NEW METRO CONVECTOR *Exclusively*

Arco-Metro Convectors, especially designed for larger housing projects which have moderate size insulated rooms, will be installed in Parkchester, the mammoth apartment community.

Write for full facts today about the Arco-Metro Convector or ask your Wholesale Distributor.

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AMERICAN RADIATOR & Standard Sanitary CORPORATION

NEW YORK PITTSBURGH

Boilers & Furnaces for Coal, Oil, Gas • Radiators • Plumbing Fixtures & Fittings • Air Conditioners • Coal & Gas Water Heaters Copper Pipe & Fittings • Oil Burners • Heating Accessories

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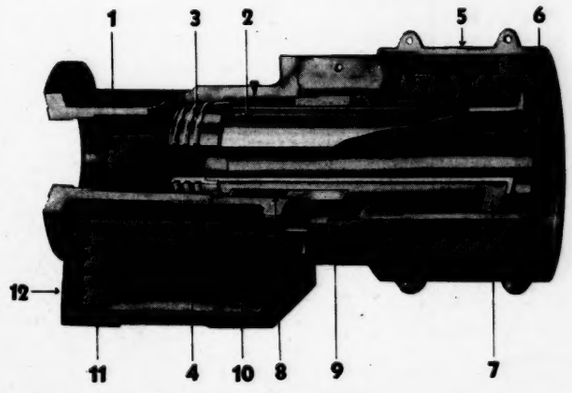
ADSCO PISTON-RING EXPANSION JOINT

Can be REPACKED UNDER PRESSURE without Service Interruption

12 Features Make This Joint Better for Your Service



Available in sizes from 2 inches for low or high pressures in single or double joints with or without anchor base, flanged or beveled ends for welding.

(1) Semi-steel or Steel body for pressures to 400 lbs. (2) Polished bronze or chromium plated steel slip. (3) Piston rings in the internal guide ring hold the line pressure while joint is being UNPACKED and REPACKED under full operating pressure without interruption to service. Internal guide acts as positive limit stop to prevent slip from pulling out of body. (4) Relief chamber and vent exhaust the steam which passes the rings during the repacking operation. (5) External, two-piece guide for outer end of slip. Packing gland easily adjustable without removing guide hood. (6) Auxiliary limit stop prevents slip from pulling out of body. A relief in the lip at bottom prevents the accumulation of sediment. (7) Guide flange moves inside machined guide hood. (8) Deep stuffing box. (9) Non-corrosive gland studs and bolts. (10) Lubrication fittings, furnished when specified. (11) Drip connection. (12) Specially designed anchor base.

Write for Bulletin No. 35-15V.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.

IN BUSINESS OVER SIXTY YEARS

Degree-Day Figures for May, 1939

HEATING & VENTILATING continues its eleventh year of publishing degree-day data for various large cities

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for May, 1939	196	42	99	14	296	304	321
Degree-days, Sept. 1, '38 to May 31, '39	6965	2594	4043	2249	5922	6655	7945
Degree-days, Sept. 1, '37 to May 31, '38	6206	2834	4178	2442	5895	6643	7608
Degree-days, Sept. 1 to May 31, Normal	6580	2890	4533	2352	6045	6810	7511

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for May, 1939	332	192	99	186	109	154	61
Degree-days, Sept. 1, '38 to May 31, '39	7173	5808	4537	5472	4952	5609	5841
Degree-days, Sept. 1, '37 to May 31, '38	6958	5986	4817	5743	5169	5287	6101
Degree-days, Sept. 1 to May 31, Normal	7340	6290	4703	6155	5398	5874	6384

	Detroit, Mich.	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for May, 1939	185	53	461	5	204	61	132
Degree-days, Sept. 1, '38 to May 31, '39	6220	4580	9240	2504	5860	3918	5711
Degree-days, Sept. 1, '37 to May 31, '38	6358	4691	9121	2140	6122	4048	6004
Degree-days, Sept. 1 to May 31, Normal	6490	5035	9245	2428	6273	4244	5925

	Fort Worth, Tex.	Grand Rapids, Mich.	Green Bay, Wis.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Ithaca, N. Y.
Degree-days for May, 1939	0	166	241	124	174	96	197
Degree-days, Sept. 1, '38 to May 31, '39	2168	6106	7345	5125	5863	4848	6458
Degree-days, Sept. 1, '37 to May 31, '38	2141	6387	7560	5191	5841	5299	6444
Degree-days, Sept. 1 to May 31, Normal	2148	6535	7825	5375	6036	5298	6719

	Kansas City, Mo.	Knoxville, Tenn.	La Crosse, Wis.	Lansing, Mich.	Lincoln, Neb.	Little Rock, Ark.	Los Angeles, Calif.
Degree-days for May, 1939	28	48	106	201	40	23	79
Degree-days, Sept. 1, '38 to May 31, '39	4474	3286	6875	6608	5296	2789	1263
Degree-days, Sept. 1, '37 to May 31, '38	4723	3357	7050	6777	5636	2790	1046
Degree-days, Sept. 1 to May 31, Normal	4852	3670	7322	7048	5999	2811	1504

	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.	Nashville, Tenn.	New Haven, Conn.
Degree-days for May, 1939	71	148	28	266	126	56	213
Degree-days, Sept. 1, '38 to May 31, '39	4009	6814	2761	6453	7714	3226	5567
Degree days, Sept. 1, '37 to May 31, '38	4233	7058	2826	6662	7700	3353	5557
Degree-days, Sept. 1 to May 31, Normal	4180	7429	2950	7206	7850	3507	5895

	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma City, Okla.	Omaha, Neb.	Peoria, Ill.	Philadelphia, Pa.
Degree-days for May, 1939	0	135	104	23	40	92	107
Degree-days, Sept. 1, '38 to May 31, '39	1008	4905	2878	3271	5597	5477	4528
Degree-days, Sept. 1, '37 to May 31, '38	1204	4955	3191	3447	5942	5674	4656
Degree-days, Sept. 1 to May 31, Normal	1024	5347	3350	3613	6131	6109	4855

	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.	Reno, Nev.	Richmond, Va.
Degree-days for May, 1939	122	373	164	229	127	215	101
Degree-days, Sept. 1, '38 to May 31, '39	4863	6929	3789	5698	4957	5104	3516
Degree days, Sept. 1, '37 to May 31, '38	5077	6907	3827	5765	4950	5247	3716
Degree-days, Sept. 1 to May 31, Normal	5235	6973	4379	6015	5389	5802	3727

	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.	Spokane, Wash.
Degree-days for May, 1939	211	45	117	246	165	239	204
Degree days, Sept. 1, '38 to May 31, '39	6433	4134	5325	2549	5901	4084	5703
Degree days, Sept. 1, '37 to May 31, '38	6387	4374	4723	2448	5912	3934	5604
Degree-days, Sept. 1 to May 31, Normal	6732	4585	5555	2681	6129	4715	6274

	Springfield, Ill.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for May, 1939	77	197	157	134	197	110	34
Degree-days, Sept. 1, '38 to May 31, '39	4874	6409	5855	4982	7028	4098	4217
Degree-days, Sept. 1, '37 to May 31, '38	5080	6243	6000	5060	6948	4257	4392
Degree-days, Sept. 1 to May 31, Normal	5373	6881	6077	4933	6796	4626	4673

Methods of applying the degree-day in connection with the operation of heating plants or for the prediction of fuel consumption of heating plants are described fully in the new enlarged edition of the DEGREE-DAY HANDBOOK, published by HEATING & VENTILATING, 148 Lafayette Street, New York, price $3. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

The Completeness of the CURTIS Line Assures the Correct Equipment for Every Air Conditioning or Refrigeration Need

WHETHER you buy, sell, install or specify air conditioning or refrigeration equipment, there's a Curtis unit that fulfills every requirement. Curtis covers a wide range of markets—makes possible greater sales. And you can specify Curtis products with absolute confidence.

The Curtis Store and Office Cooler fulfills the air conditioning demands of all classes of retail establishments. It's a complete, factory designed, packaged air conditioning unit. It mechanically cools, dehumidifies, circulates and filters the air—is quickly and easily installed with only water and electrical connections needed—adaptable for heating, too. It is offered in 3 and 5 ton sizes.

The Curtis Line of Condensing Units includes sizes from 1–6 H. P. to 30 tons air and water cooled—also unit coolers, coils, evaporative condensers, etc. Every Curtis product is precision engineered to deliver economical, efficient, care-free performance throughout an exceptionally long life.

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Division of
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CURTIS REFRIGERATION AIR CONDITIONING AND COMMERCIAL

"Builders of Condensing Units Since 1926"

48 Air Cooled Units—45 Water Cooled Units —1/6 to 30 H.P.

The Curtis Store and Office Cooler 3 and 5 ton sizes

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The Conduit for Underground Steam Lines

SIMPLEST
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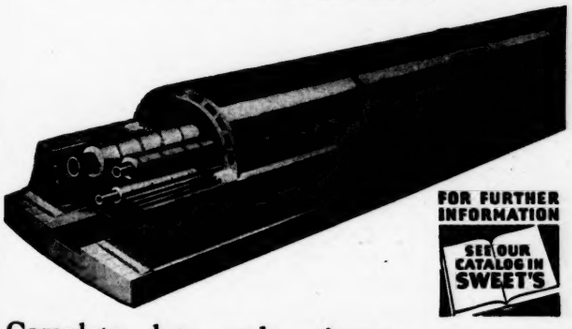

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AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

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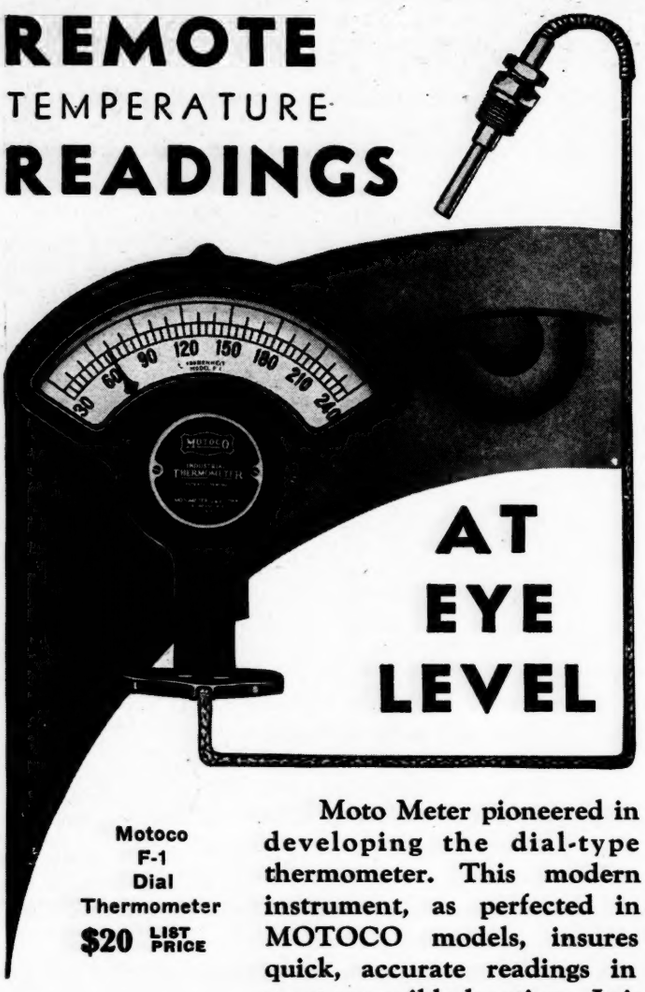

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Motoco F-1 Dial Thermometer
$20 LIST PRICE

Moto Meter pioneered in developing the dial-type thermometer. This modern instrument, as perfected in MOTOCO models, insures quick, accurate readings in most accessible locations. It is a valuable addition to any equipment requiring temperature regulation.

MOTOCO thermometers have easily read, evenly calibrated dials . . . are made with solid liquid filled movement. They are sturdily constructed without gears, pinions or delicate hair springs to get out of order. Rigid stem for direct mounting or capillary tubing for remote reading.

Install MOTOCO dial-type thermometers wherever temperature is an important factor. They are priced so low that installation can be made at every point where temperature indication is desired.

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MOTOCO
INDUSTRIAL THERMOMETERS

SUMMER DEGREE-HOURS (ABOVE 85F) MAY, 1939

City	May, 1939	May, 1938	Year 1939 to May 31	Year 1938 to May 31
Baltimore	190	0	200	6
Bismarck	80	0	82	0
Boston	14	0	14	19
Buffalo	0	2	0	2
Chicago	14	11	14	11
Cincinnati	24	4	24	4
Cleveland	2	0	2	0
Columbus	99	12	99	12
Des Moines	288	0	289	0
Detroit	33	0	33	0
Grand Rapids	17	3	17	3
Houston	179	71	206	71
Indianapolis	95	0	95	0
Kansas City	227	11	227	12
Memphis	13	37	13	37
Minneapolis	106	0	106	0
New Orleans	30	105	30	105
New York	38	0	38	0
Philadelphia	108	0	108	0
Pittsburgh	45	1	45	2
Richmond, Va.	131	45	134	46
St. Louis	56	8	56	17
San Diego	0	0	15	0
San Francisco	0	0	0	0
Savannah	106	419	120	567
Toledo	23	7	23	7
Washington	210	2	235	14

COMING EVENTS

SEPTEMBER 20-22, 1939. Annual Conference, National Industrial Advertisers Association, Hotel New Yorker, New York. Headquarters NIAA, 100 East Ohio St., Chicago.

OCTOBER 4-6, 1939. Exposition of Building, Industry and Services, Hotel Statler, Detroit, Mich. Sponsored by the Mortgage Bankers Association of America. George H. Patterson, Secretary-Treasurer, 111 West Washington St., Chicago, Ill.

JANUARY 15-18, 1940. Sixth annual convention of the Refrigeration Service Engineers Society in conjunction with the Second All-Industry Refrigeration and Air Conditioning Exhibition sponsored by the Refrigeration Equipment Manufacturers Association, to be held in Chicago. National Secretary of the Society, H. T. McDermott, 433 N. Waller Ave., Chicago.

JANUARY 16-18, 1940. 35th Annual Meeting, American Society of Refrigerating Engineers, Hotel Blackstone, Chicago, Ill. ASRE headquarters, 37 West 39th St., New York.

JANUARY 22-24, 1940. Annual convention, National Warm Air Heating and Air Conditioning Association, Hotel Hollenden, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. NWAH & AC Assoc., Managing Director, 5 E. Long St., Columbus.

JANUARY 22-26, 1940. 46th annual meeting of the American Society of Heating and Ventilating Engineers, Hotel Statler, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. ASHVE, 51 Madison Ave., New York.

JANUARY 22-26, 1940. Sixth International Heating and Ventilating Exposition to be held at Lakeside Hall, Cleveland. Exposition under the direction of Charles F. Roth, International Exposition Co., Grand Central Palace, New York.

WITH THE MANUFACTURERS

(Concluded from page 73)

Airtemp Div., Chrysler Corp., Dayton, Ohio, has appointed *R. C. Robertson*, assistant general sales manager. *E. D. Knowles* has been made manager of the Dayton regional office.

The American Rolling Mill Co., Middletown, Ohio, has appointed *Foster E. Wortley*, manager of its Cleveland district sales office, as assistant manager of the mid-western sales area, effective May 16. *Henry L. Woods, Jr.*, has been appointed manager of the Cleveland office to succeed Mr. Wortley.

Canton Stoker Corp., Canton, Ohio, has appointed *H. R. Stevens* as Eastern district manager, covering New England, Eastern New York and New Jersey, and with offices at 10 High Street, Boston. Mr. Stevens was formerly district manager for Detroit Stoker Co., and prior to that time, operated the Boiler Equipment Co., in Connecticut.

Gay Engineering Corp., Los Angeles, Calif., announces that it will represent Carrier Corporation in 11 western states.

The Emerson Electric Mfg. Co., St. Louis, Mo., has moved its New York City district office to Suite 1945, Graybar Building, 420 Lexington Avenue.

The Fedders Manufacturing Co., Inc., Buffalo, N. Y., announces the resignation of *H. E. Rieckelman*, former vice-president in charge of sales of refrigeration and air conditioning products. His duties will be taken over by *W. D. Keefe*, who has been with the Company for the past 17 years.

DeBothezat Ventilating Equipment Div. of American Machine and Metals, Inc., New York, has transferred its sales offices to East Moline, Ill., where the manufacturing plants of the company are located.

General Electric Co., Schenectady, N. Y., has appointed *Stuart M. Crocker* as manager of its air conditioning department, effective early in May; at the same time it was announced that the commercial refrigeration activities of the company have been transferred from the merchandise department to the air conditioning department.

Leslie Co., Lynhurst, N. J., has taken over the manufacture and sale of Mott (formerly Yarway) temperature controls.

H. A. Thrush Co., Peru, Ind., has established a sales office in Hartford, Conn. *H. E. Thompson*, formerly with the Philadelphia office will be Eastern representative for Western New England. The company has also appointed the following: *H. T. Waterstraat* as representative in the Albany area; *O. T. Cole*, Mississippi and Alabama representative with headquarters in Tuscaloosa; *J. R. Dowdell* as sales representative for Texas with offices in Dallas; and *S. G. Anstey* as sales representative in Southern California and Arizona, with offices in Los Angeles.

Revere Copper and Brass Inc., Detroit, has appointed *C. H. Kuthe* as technical advisor to the company's Michigan Division. Mr. Kuthe will report directly to *C. W. Thomas*, vice president and general manager of the Division, which has its headquarters at 5851 West Jefferson Ave., Detroit.

"NOISY? NO, SIR! AND SAFE AGAINST FIRE, TOO!"

YOU won't have complaints about noise in ducts if you install J-M Airacoustic Sheets as linings. This new-type material does a permanent quieting job. And it gives clients an extra advantage they'll all appreciate . . . maximum protection against fire.

Such important advantages are possible because Airacoustic Sheets are basically mineral. They absorb more than 70% of all sounds in ducts. Their high moisture resistance and transverse strength assure low upkeep. Systems are safer, for Airacoustic Sheets do not support flame . . . effectively retard the spread of fire.

You can use J-M Airacoustic Sheets for lining any type of duct. They are light in weight, easy and economical to apply. Including them in all your installations helps assure a thoroughly satisfactory job every time. For details on this modern lining, write Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville

AIRACOUSTIC SHEETS For Duct Linings

We are the three Williams' sons—Will, Willie and Bill. We will save you time and help you make more money on your gravity and air-conditioning installations through the use of

FAVOR-LOX Prefabricated Duct and Fittings. Beautiful installations. No bolts or screws needed. No loose "S" Hooks or Drive Straps. Minimum of cutting. Dealers report installation time cut 50%.

FAVORITE PIPE and Fittings for Gravity. Complete line, die-cut. No hammering. Perfect fit, good looking installations in less time.

FREE: *Complete, easily understood short method for figuring air conditioning jobs. You can complete your figures and price job in one hour flat. Write—Dept. 5 for prices and catalogs.*

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TRIPL-LIFE Complete Line Quick Service FLO-WARM

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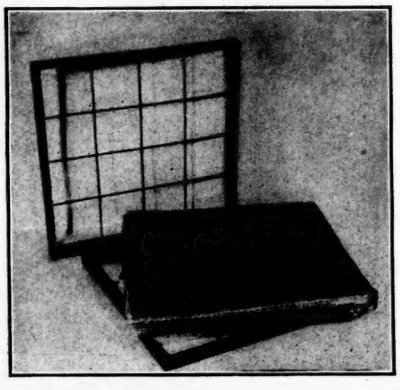
Re-Fil-Able Walton Air Filters



The steel frames of the New Walton Air Filters are a permanent part of the installation. Filter pads require no fibre frames and can be easily replaced. Pads are treated with an odorless oil which increases greatly their dust holding capacity.

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make Walton Air Filters an integral part of your air conditioning equipment.

EASIER INSTALLATION
Frame design is neater and simpler, saving space and simplifying installation.

GREATER REPEAT BUSINESS
Walton pack need no fibre frames—your customers get greater value and you get a greater volume of refill business.

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NEW TRADE LITERATURE

Air Conditioning. A six-page folded bulletin, C-1100-B3, describing the Worthington-Carbondale combined unit air conditioner, which is used for air conditioning small stores, shops, offices or other limited space. Gives information on the construction, features, typical installation arrangements and sizes available. CARBONDALE DIVISION, WORTHINGTON PUMP & MACHINERY CORP., HARRISON, N. J. 22

Controls. An eight-page bulletin, No. 106, describing the Genuine Detroit air conditioning controls and refrigerating equipment. Gives information, specifications and list prices of automatic and thermostatic expansion valves, strainers, humidistats, thermostats, pressure control switches, and other refrigerant and air conditioning controls. DETROIT LUBRICATOR CO., DETROIT, MICH. 23

Controls. A standard-size, 38-page catalog covering the complete line of General controls. Gives information on the construction, features, installation, maintenance, size and list prices of the various devices in this company's line. Some of the devices described include magnetic industrial valves for water, oil, gas, steam and refrigerants; thermostats; gas controls; slow opening valves; gas boiler regulators and strainers. GENERAL CONTROLS CO., CHICAGO, ILL. 24

Corrosion. A 10-page, pocket-size booklet entitled "Corrosion in the Refrigeration Industry." Gives information on the chromate treatment of brine; brine testing; brine treating; preparation of new brine and maintenance of the chromate solution. MUTUAL CHEMICAL CO. OF AMERICA, NEW YORK. 25

Evaporative Condensers. A standard-size, four-page bulletin, No. 234-B, on Frick evaporative condensers for ammonia and Freon systems. Describes the use of evaporative condensers, features, gives roughing-in dimensions and data on capacities. FRICK CO., WAYNESBORO, PA. 26

Fans. A standard-size, 24-page catalog, X3300, listing nearly a hundred models of all types of Emerson electric fans. Includes description of desk and stand fans, circulators, ceiling fans, exhaust and ventilating fans. Gives descriptions, detail construction, performance and price list. THE EMERSON ELECTRIC MFG. CO., ST. LOUIS, MO. 27

Fire Control. A standard-size, eight-page bulletin on automatic fire control systems for air conditioning and ventilating systems. Bulletin describes a service offered by the American District Telegraph Co. which makes possible the automatic indication of fires in air conditioning and ventilating systems. This company serves more than 350 cities and towns throughout the United States and the service offered is said to automatically detect any fire or smoke in air conditioning equipment, to instantly shut off the air conditioning system, close dampers and provide a means for summoning the fire department. AMERICAN DISTRICT TELEGRAPH CO., NEW YORK. 28

Heating Specialties. A standard-size, 16-page catalog, No. 45, describing Sarco heating specialties for vapor and vacuum heating systems. Also gives data on capacity and dimensions. SARCO CO., INC., NEW YORK. 29

Instruments. A standard-size bulletin, 536, giving complete information on Bristol's pH recording and controlling instruments. Includes a description of the recording and controlling instruments, the amplifier unit and the electrodes and lead wire. BRISTOL CO., WATERBURY, CONN. 30

Metallic Bellows. A standard-size, 44-page data book on the Clifford Hydron metallic bellows, written especially for all users of bellows. Book opens with a description of the characteristics and properties of Hydron bellows, discusses the advantages and disadvantages of various materials, gives tabular data on sizes and characteristics, sketches of standard types of bellows, information on the prediction of life, instructions for ordering, details of assembling, soldering and cleaning. The second half of the book describes the complete Hydron bellows assemblies for the remote control of temperature. This section discusses the various charges that are available and gives information on performance. It also takes up bellows for steam traps and shaft seals. A technical section at the end of the book offers data on coefficients of cubical expansion, common conversion factors, circumferences and areas of circles, linear volumes of tubing used for capillary and thermal bulbs, and a large size chart on vapor pressure, temperature curves of typical filling mediums. CLIFFORD MFG. CO., BOSTON, MASS. 31

Pipe. A standard-size, 40-page catalog, No. 15, listing the complete line of Devlin pipe fittings. Catalog covers the following malleable iron fittings: iron boiler fittings, iron railing fittings, and pipe fittings, also cast iron fittings and brass fittings; unions; union fittings; heavy oil malleable iron fittings; and nipples. Gives information on sizes and prices. THOMAS DEVLIN MFG. CO., INC., BURLINGTON, N. J. 32

Registers. A standard-size, 48-page catalog, No. 39AC, giving information on the complete line of Hart & Cooley registers and grilles. The catalog is prepared so that the front and back of a single page describes completely each type of register or grille. A 10-page technical section in the beginning of the book gives information on register and grille selection for residential air conditioning. HART & COOLEY MFG. CO., HOLLAND, MICH. 33

Registers. A standard-size, 16-page catalog, No. 39A, describing the Air Control Products, Inc. line of air conditioning grilles and damper control sets. Gives information on the construction, features, and list prices of various registers and grilles and also gives information on the method of selecting registers and grilles for residential air conditioning. AIR CONTROL PRODUCTS, INC., MUSKEGON, MICH. 34

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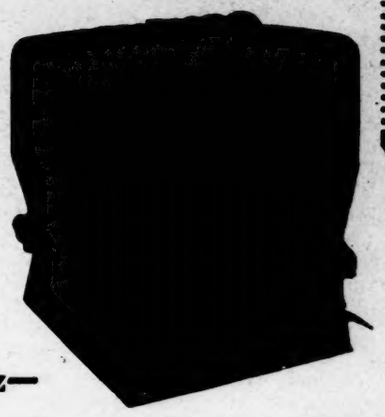

This hyar foresight boiler does a heating job fur anywheres from 7,850 to 19,450 sq. ft. of E.D.R. Steam Rating. Water from 12,600 to 31,800 sq. ft. Made in 9 sizes.

Hank Sez—

He Knows of a Foresight Boiler that Takes Out the Hindsights

Crying about spilt milk, never put any cream in a feller's coffee.

Putting in a boiler which you wish you had *put out,* (and have to anyway) never put any money in yer sock.

If I wuz a building an apartment house, seems like I'd start a thinking about two things first about a boiler.

I'd think about getting it in. Think whether I'd have ter leave a big open hole some place fur wrangling it with a big tackle? Or whether I needn't leave any hole, because with a Burnham Cast Iron Big Twin, I could pass the sections and base thru any door, I could get thru without knocking off skin.

Then I'd say, basement space is valuable, so why buy a Steel Boiler what has to have room in front or back of it, as long as the boiler itself, fur cleaning the tubes or putting in new ones.

That kind o'thinking would be *foresight.*

Then I'd say, suppose I put in a Steel Boiler and sometime wanted it to do more heating than it wuz made ter do. Then I'd be plumb out of luck, and wish I'd bought a Burnham to which I could have added sections.

That would be *hindsight,* which never dun anyone any good.

We make both Steel and Cast Irons. All I give a hoot about is to help you get, both what you want, and what yer oughter have.

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